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Lightweight Towed Howitzer Demonstrator

Final Report

Volume D1 - Part I

Structural Analysis

(Less Cradle and System)



April 1987

Contract Number DAAA21-86-C-0047

FMC CORPORATION
Northern Ordnance Division
4800 East River Road
Minneapolis, Minnesota 55421

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REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM				
1. REPORT NUMBER 2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER				
4. TITLE (and Subtitle)	5. TYPE OF REPORT & PERIOD COVERED				
Final report for the Lightweight Towed Howitzer Demonstrator	Final: 20 December 1985 ~ 13 March 1987				
	6. PERFORMING ORG. REPORT NUMBER E-3041				
7. AUTHOR(s)	8. CONTRACT OR GRANT NUMBER(s)				
Robert Rathe, FMC Program Manager	DAAA21-86-C-0047				
Bart Anderson, FMC Project Manager					
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS				
FMC CORPORATION, Northern Ordnance Division	Item 0001				
4800 East River Road	LTHD Phase I and Partial				
Minneapolis MN 55421	Phase II				
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE				
AMCCOM	April 1987				
AMSMC-PCW-A(D)	13. NUMBER OF PAGES				
Dover NJ 07801-5001	4,856				
14. MONITORING AGENCY NAME & ADDRESS(II ditterent from Controlling Office)	15. SECURITY CLASS. (of this report)				
AMCCOM AMCMC FGA F	Unclassified				
AMSMC-FSA-F	154. DECLASSIFICATION/DOWNGRADING				
Dover NJ 07801-5001	N/A				
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18. SUPPLEMENTARY NOTES					
None					
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19. KEY WORDS (Continue on reverse side if necessary and identity by block number) 55mm towed gun howitzer, advanced weapons, composite cradle, composite hydraulic actuators, composite trails, field artillery weapon, firing stability analysis, howitzers, hydraulic control valves with force feedback, hydraulic joystick control of gun direction, hydraulic inertial rammer, hydraulic opening breech, hydraulic primer autoloader, lightweight towed howitzer demonstrator (LIHD) load out of battery howitzer, mortar howitzer, recoil energy recovery, recoil mechanism using metal matrix composites, titanium muzzle brake, titanium platform, titanium spade, titanium walking beams, thermal stability, towing stability analysis, unconvertional weapons, and unipht reduction of artillary. 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The LTHD (Lightweight Towed Howitzer Demonstrator) was to be a 9,000 lb equivalent to the M198, transportable via Blackhawk helicopter, with reduced emplacement time using fewer personnel. The FMC design achieved weight reduction via a mortar-like configuration, composites structure, and hydraulic actuators. Recovery of power from the recoil system, in turn, facilitated crew reduction via hydraulic emplacement, four-way joystick tube lay, and power ramming. FMC completed Concept Development (Ph I) and two-thirds of Detailed Design (Ph II) prior to funds running out.					
two-thirds of Detailed Design (Ph II) prior to fun	ds running out. Kerneards;				

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Vol/Sec	Description
Di	Structural Analysis less Cradle and System
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D1/060	Computer File Inventory
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D1/120	Equilibration Link Assembly
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D1/140	Gimbal
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D1/180	Muzzle Brake (titanium)
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DESCRIFTION: COMPUTER FILE INVENTORY

STATUS: A complete listing of all computer programs and data files used in performing structural analysis is included in this section. Individual programs and files are described in the sections of this volume where appropriate.

Also included is a listing of all CAD files used for the LTHD. These files were also provided to ARDEC on tape with Cyber format.

AUTHOR: Dave Langerud, Larry Libhardt, Charles Ortloff, Jim Ries, Joe Fishbein. CAD drawing files are by the respective designer/drafters.

TT: D. LANGERUD

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FOLT: JIM DILLON

SYSTEM : NAM THAT (MENUS)

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4-3-87 Libhardt

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Central Engineering Laboratories Santa Clara

Interoffice

to L. Libhardt

Date March 19, 1987

From

C. R. Ortloff

cc E. Thuse
A. Amberg

R. Kazares

Subject

LIST OF COMPUTER FILES RELATED TO THE LWHD, PHASE II PROJECT

In response to your request of 3/16/87, I am enclosing a list of computer files related to the LWHD system finite element models. Details are provided on the attachment.

C. R. Ortloff

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CBL PILE	SOFTWARE	DESCRIPTION	RESIDENCE	WHERE STORED	FILE SIZE (BLOCKS)
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0 095-12585867/A LOAD TRAY	2		LTLTRAY		
M MOT-12585840/A FRAME, TROLLEY	1		LTLTRAY		
T-12585837/A PAD, BEARING	1		LTLTRAY		
T-12585818/A SUPPORT (TOP PLATE/FRAME) 11-12585773/A PLATE, AFT 11-12585814/A STRUT, FOREWARD	1	TAPE3	LTLTRAY		
% %%-12585773/A PLATE, AFT	1	TAPE3	LTLTRAY		
∰ "Y-12585814/A STRUT, FOREWARD	1	TAPE3	LTLTRAY		
T-12585883/A HOUSING	1	TAPE3	LTLTRAY		
ፙ ፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟፟ዀ 12585867∕A LOAD TRAY	1		LTLTRAY		
-12585783/A ROD	1		LTLTRAY		
	ī		LTLTRAY		
T-12585833/A PLATE, TOP T-12585885/A SUPPORT (SIDES) T-12585815/A STRUT, REAR T-12585940/A BAR, TRACK SUPPORT T-12585930/A BAR, TRACK SUPPORT T-12585869/A BASE SPRING, PROJ.	ī		LTLTRAY		
-12585815/A STRUT. REAR	ī		LTLTRAY		
N W-12585940/A BAR. TRACK SUPPORT	ī		LTLTRAY		
T-12585930/A BAR, TRACK SUPPORT	ī		LTLTRAY		
20-12585869/A BASE SPRING, PROJ.	î		LTLTRAY		
12585778/A SIREVE	i		LTLTRAY		
12585778/A SLEEVE 2585881/A RETAINER, PLATE	i		LTLTRAY		
T-12585870/A BACKUP STRIP	1				
N WASSIGN SWING STATE	7	TULED	LTLTRAY		
2585881/A RETAINER, PLATE T-12585870/A BACKUP STRIP				PAGE	2
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SHEET TYPE FILE

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6-8
   T-12585871/A BRACKET, BACKSTOP MTG
                                                                1 TAPE3 LTLTRAY
   T-12585737/A BLOCK, CLEVIS
                                                                1
                                                                   TAPE3
                                                                            LTLTRAY
   T-12585817/A PIN, PIVOT(STRUT/CLEVIS)
                                                                1
                                                                    TAPE3
                                                                            LTLTRAY
   T-12585884/A PAD, BEARING
                                                                1
                                                                   TAPE3
                                                                            LTLTRAY
  T-12585886/A HEADED PIN
                                                                1
                                                                   TAPE3
                                                                            LTLTRAY
      1.2585868/A WEARSTRIP
                                                               1
                                                                  TAPE3
                                                                            LTLTRAY
    12585861/A PIN, PIVOT (1.937 LG)
                                                               1 TAPE3
                                                                            LTLTRAY
   T-12585890/A WASHER, BUMPER
                                                               1 TAPE3
                                                                            LTLTRAY
   T-12585887/A ROLLER
                                                               1 TAPE3
                                                                            LTLTRAY
                                                               1 TAPE3
                                                                           LTLTRAY
   T-12585962/A ROLLER(1.406 LG)
                                                                1 TAPE3
  T-12585929/A BAR, TRACK SUPPORT
T-12585949/A DAR, IRROR SUPPORT BAR)
T-12585981/A SPACER
T-12585981/A SPACER
                                                                            LTLTRAY
                                                          1 TAPE3
1 TAPE3
                                                                            LTLTRAY
                                                                            LTLTRAY
T-12585981/A SPACER
T-12585768/A PLATE, FOREWARD
T-12585949/A ORIFICE ROD, RECOIL
T-12585954/A COLLAR, RECOIL
T-12585955/A NUT, RECOIL
T-12585955/A NUT, RECOIL
T-12585782/B CLAMP PLATE, RAIL
T-12585951/A FND CAR FRONT
                                                                   TAPE3
                                                                1
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   T-12585951/A END CAP, FRONT
                                                               2
                                                                   TAPE3
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T-12585946/A CYLINDER, C'RECOIL
T-12585950/A GUIDE ROD, C'RECOIL
T-12585945/B CYLINDER, RECOIL
                                                               1 TAPE3
                                                                            LWTOWED
                                                            1 TAPE3
1 TAPE3
1 TAPE3
2 TAPE3
1 TAPE3
2 TAPE3
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   T-12585975/A CYL. C'REC, ENRGY, RECOV
                                                                             LWTOWED
 T-12585975/A CYL. C'REC, ENRGY, RECOV
                                                                            LWTOWED
 T-12585946/A CYLINDER, C'RECOIL
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   22
                                                               2 TAPE3
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   T-12585951/A END CAP, FRONT
                                                               1
                                                                   TAPE3
                                                                            LWTOWED
T-12585952/A END CAP, REAR
                                                                1
                                                                    TAPE3
                                                                            LWTOWED
T-12585948/B ROD, C'RECOIL
                                                               1
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                                                                             LWTOWED
   ™-12585945/B
                   CYLINDER, RECOIL
                                                                2
                                                                    TAPE3
                                                                             LWTOWED
   12585953/B
                   WASHER, END CAP
                                                                1
                                                                    TAPE3
                                                                             LWTOWED
T-12585956/B WAY BEARING
T-12585960/B SLIDE BUSHING, INSIDE
T-12585961/B SLIDE BUSHING, OUTSIDE
T-12585959/B TORQUE PIN, BOTTOM
T-12585947/B ROD, RECOIL
T-12585957/B WAY BEARING M/CROOVE
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   T-12585957/B WAY BEARING W/GROOVE
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   BULKHEAD, LAYOUT
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5863
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  MID MANIFOLD
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  CRADLE
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T-12585821/A
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                 SPADE
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  SPEED
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√LOADTRAY LAYOUT

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  I TAD C130 W/ LTHD6
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    :1 CRADLE MACH
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 BPEED
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  TRAIL ASSEMBLY
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005831 CRADLE MACH
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 PLATFORM
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REECH
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 OUTER BAND
PADE
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  CRADLE
CRADLE DETAIL
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 MANDREL
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LOADTRAY LAYOUT SLIDE
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  OADTRAY LAYOUT
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LOADTRAY LAYOUT
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  SPEEDSHIFT LAYOUT
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  LOADTRAY LAYOUT SLIDE
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  ....EELS
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  CANNON
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  BREECH
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  SLIDE
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PLATFORM FRAME
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  GIMBAL
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  GIMBAL
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FIRING CHART
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                                                         TAPE3
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  LTHD
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 MUZZLE BRAKE
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LTHD NEW WHEELS
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                                                                LTHD869
  CANNON ASSY
                                                         TAPE3
                                                                LTHD869
  BARREL & BREECH
                                                      1
                                                         TAPE3
                                                                 LTHD869
  FIRE CONTROL MEASUREMENT ERROR
DISPLACEMENT TIMELINE
                                                         TAPE3
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  LTHD
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 U. LOADING
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LOAD C130
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  LTHD
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LTHD, HIDDEN CLAWS UP
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₹ SLIDE
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  EMPLACEMENT TIMELINE
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  '^AD C130 W/ LTHD6
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  PLATFORM
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TRAIL W/ COMPOSITE TOP & BOTTOM
                                                      2
                                                         TAPE3
                                                                LTHD869
  TIME LINE FOR MAX RATE OF FIRE
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  LOADTRAY LAYOUT, TRAY AT 0 DEG.
                                                         TAPE3
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  WHEEL UNIT
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FIRE CONTROL
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 RECIL MECHANISM
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SPEEDSHIFT TIMELINE
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  PAL
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AUTOPRIMMER
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  LTHD, BOX SLIDES
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                                                                LTKENT1
  HYD SCH LTHD
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HYD SCH LTHD
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... MUZZLE BRAKE/ HITCH
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  CRADLE & TRAIL ASSY
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DOLLY ASSY CANNON ASSY
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SLIDE ASSY
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  CANNON ASSY
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10 TAPE3 LTKENT1 6 TAPE3 LTKENT1

	TULTHD	4	TAPE3	LTKENT1		6
	LAPES	3		LTKENT1		
, 1	LTHD ASSY	2		LTKENT1		
	LTHD	. 5		LTKENT1		
	MUZZLE	10		LTKENT1		
}	RECOIL FORCE VS STROKE	1		LTHDGRA		น
	(IMUM ALLOWABLE DECELERATING	1		LTHDGRA		
l	LRY	1		LTHDGRA		
	MASS MOMENT OF INERTIA	1		LTHDGRA		
'	MUZZLE VELOCITY VS RANGE	1		LTHDGRA		
	CENTER OF GRAVITY VS STROKE	1		LTHDGRA		
	RECOIL RECOILING MASS CANNON ASSY	10		LTHDGRA		
	CARECULLING MASS	1		LTHDGRA		
		1		LTHDDWG		22
l	DOLLY ASSY	1 2		LTHDDWG LTHDDWG		
	LTHD ASSY MPLATFORM ASSY	2		LTHDDWG		
'		2	TAPES			
	TRAIL ASSY, RH	2		LTHDDWG LTHDDWG		
	TRAIL ASSY LH	2	TWLF?	LTHDDWG		
	(MILANIU ROOI, UR MA 22	2	TWLED	LTHDDWG		
	GIMBAL DETAIL	2		LTHDDWG		
		2		LINDDWG		
	MPLATFORM, UPPER DETAIL PLATFORM, LOWER DETAIL	2		LTHDDWG		
	CRADLE & TRAIL ASSY	2		LTHDDWG		
	CREW POSITIONS			LTHDDWG		
	MBATTERY POSITION, 0 QE	10		LTHDDWG		
	LTHD AT 33.75 DEGREES	20		LTHDDWG		
	FORCES, LH TRAIL	20		LTHDDWG		
	NUSLIDE	i		LTHDDWG		
1	MSLIDE USLIDE ASSY	ī		LTHDDWG		
	FORCES, SLIDE	20		LTHDDWG		
	COUNTERRECOIL CYL	i	_	LTHDDWG		
1	RCES, UPPER PLATFORM	20		LTHDDWG		
	FORCES, LOWER PLATFORM			LTHDDWG		
ì	TASK ORDER SCHEDULE			LTHDDWG		
	HYD SYSTEM	2		LTHDDWG		
,	RECOIL CYLINDER <	1		LTHDDWG		
į	MCMUZZLE BRAKE	1	TAPE3	LTHDDWG		
i	LAPES	2		LTHKENT		13
l	LAPES	3	-	LTHKENT		
	TALOAD	4		LTHKENT		
1	MAP	1		LTHKENT		
1	LTHD -18	1		LTHKENT		
	CANNON	1		LTHKENT		
•	₩HYD SCH	1		LTHKENT		
	HYD SCH LTHD	2		LTHKENT		
ı	HYDSYS	1		LTHKENT		
4	HYDSYS	2		LTHKENT		
	ELEVCYL	1		LTHKENT		
	HYDSYS	3		LTHKENT		
•	(XLAYOUT, LAPES	1		LTHKENT		
•	MHOUSE	1		LTHKENT		
l	HYD SCH LTRD	3	TAPE3	LTHKENT		
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1	LTHD LATTICE	10		LTHKENT		
زر	TIME TABLE	1		LTHKENT		
	MUZZEL BRAKE/HITCH	1		LTHKENT		
Ĭ	CAM PLATE	1	TAPE3	LTHKENT		/
i	r. ²²	2	TAPE3	LTHKENT		(17
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BARREL PROFILE 1 TAPES			/ / / / / / / / / / / / / / / / / / /
BRAREL PROFILE BRAREL PROFILE \$ SPADE \$ 1 TAPES \$ SPADE \$ 2 TAPES \$ L'HD, LOW ELEV CYL \$ 2 TAPES \$ BREECL ASSY \$ 5 TAPES \$ SPADE HOLDING, SAND \$ SPADE HOLDING, LOAM \$ SPADE HOLDING, LOAM \$ 10 TAPES \$ RECOLL FORCE VS STROKE \$ 10 TAPES \$ RECOLLING MASS \$ 2 TAPES \$ RECOLLING MASS \$ 2 TAPES \$ 2 TAPES \$ 2 TAPES \$ 2 TAPES \$ 3 TAPES \$ 3 TAPES \$ 4 TAPES \$ 4 TAPES \$ 4 TAPES \$ 10 TAPES	LTHKEN	T	6-
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L'HD, LOW ELEV CYL C130 C130 C130 LZEL BRAKE /HITCH LZEL REACTION SPADE HOLDING, SAND SPADE HOLDING, LOAM LAPES SPADE HOLDING, CLAY RECOLL FORCE VS STROKE LO TAPES COUNTERRECOIL CUSHION MUZZLE VELOCITY VS RANGE LO TAPES RECOLLING MASS BATTERY POSITION, O QE LOAD C130 LOAD C130 LOAD C130 LOAD C130 LOAD C130 LOAD C130 LAPES L	LTHKEN		
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111 W. Evelyn Ave., Suite 301 Sunnyvale, California 94086 (408) 736-1636

March 20, 1987

Larry Libhardt FMC Corporation 3989 Central Ave NE Minneapolis, Minn 55421

Dear Larry,

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Enclosed is the listing of the files which were on our RIDGE 32 computer as of 3/20/87. The binary results files were deleted in order to conserve disk space. We did save all of the input files and these have been transferred to a magnetic tape which we will keep in our tape library for at least 2 years. This information could be transmitted to you on a standard ascii tape or on a PC floppy if necessary. It was a pleasure working with you and if we can be of any assistance in the future please do not hesitate to call.

Best regards,

Mark C. Rodon In

Mark C. Rodamaker

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LTHD Structural Analysis File Summary

Joe Fishbein 18 March 1987

All files listed below are for the IMAGES-3D Finite Element Program. Except where noted, all files were created under Version 1.3 of the program.

Each file consists of 18-31 sub-files (e.g. GUNRAIL.GEO, GUNRAIL.DIS, etc.) which are generated and used by IMAGES. The listing "filename.*" implies the entire group of sub-files.

All files are stored on labeled diskettes. -> Larry Libhardt has two boxes.

		rins two boxes.
File	Disk Label	Description
CLAMPBAR.*	LTHDFEM2	Clamp bar for fastening collar to rail. 1/2 symmetric model of section "slice" under bolt tension loading.
COLLAR2.*	LTHDFEM2	(Version 1.1) Keyed section of original collar. 1/2 symmetric model of "slice" under recoil torque load. Two runs with sym./anti-sym. boundary conditions were run and combined. This geometry is obsolete.
GUNRAIL.*	LTHDFEM1	Cannon guide rail, with barrel and collars. Simple beam model to determine loading in rail from recoil torque at various barrel positions within manifolds.
IBBAND.*	LTHDFEM1	(Version 1.1) Inner breech band. Cross-section "slice" with loading from cannon recoil.
LTHDHUB.*	LTHDHUB1- LTHDHUB6 (6 disks)	Wheel hub. Half-symmetric plate model, with plate elements of various thicknesses for the different areas. Bump/skid and 4.5G Air Drop loadings.
LTHDHUBA.*	LTHDFEM3	Wheel hub. Simple beam model of hub under transport loadings listed above.
OBBAND.*	LTHDFEM1	Outer breech band. 1/4-symmetric model under cannon recoil, supported by cylinders at corners.
TESTRING.*	LTHDFEM4 LTHDFEM5	Speed shift plate — initial test model. 1/2 symmetric model of uniform circular plate with central hole, supported at 3 equidistant points on outer radius and continuously loaded on inner radius.

LTHD Structural Analysis File Summary (continued)

File	Disk Label	Description
TESTRNG2.#	LTHDFEM6 LTHDFEM7 LTHDFEM8	Speed shift plate refined model. Same geometry as TESTRING, but with tapered plate for better stresses and a more detailed model.
TPMANFLD.*	LTHDFEM3	Middle manifold projection that engages torque pin. "Slice" model under triangular loading from recoil torque.
TRAILDIA.*	LTHDFEM3	Titanium diaphragm on trail, with loading from wheel actuator cylinders.

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DISK LABEL: LTHOFEM1

FILENAME	DESCRIPTION	S/ZE
088AND.*	IMAGES 3D V 1.3 MODEL OF LTHD OUTER BREECH BAND, 1/4 - SYMMETRIC MODEL. IMPACT WAD FROM CONNON RECOIL.	1925/2
IBBAND.*	IMAGES 30 V 1.1 MODEL OF LTHD INNER BREECH BAND. CROSS-SECTION "SLICE", IMPACT LOAD FROM CANNON RECOIL	87040
GUNRAIL.*	IMAGES 3D VI. 3 MODEL OF LTHO CONNON GUIDE RAIL, WITH CANNON AND COLLAR "ARMS". TORQUE (RIFLING) ON CONNON, RESISTED BY MANIFOLDS (SUPPORTS) ALONG RAILS.	6553 6

DISK LABEL: LTHOFEM2

DESCRIPTION

FILENAME

COLLAR 2.*	IMAGES 30 VI. / MODEL OF LTND BARREL COLLAR - 1/2 SYMMETRIC MODEL OF SECTION THROUGH KEYED AREA. 2 SYM/ASYM LOAD CASES. TORQUE LOAD FROM RIFLING. (GEOMETRY CHANGED ON FINAL DWG.)	235520
CLAMPBAR.*	IMAGES 3D VI.3 MODEL OF LTHD CLAMP FOR FASTENING RAIL TO COLLAR 1/2 SYM. MODEL OF "SLICE" - BOLT TENSION LOAD.	71680

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OISK LABEL	: LTHDFEM3	
FILMAME	DESCRIPTION	5/ZE
TRAILOIA.*	DIAPHRAM FOR LTHD TRAIL, LOADED BY WHEEL ACTUATOR CYLINDERS AND BASE LOADS FROM TRANSPORT	
TPMANFLD.*	MODEL OF MANIFOLD SECTION IN AREA OF TURQUE PINS, WITH TRIANGULAR LOAD FROM RIFLING TORQUE	175104
LTHDHUBA.*	SIMPLE BEAM MODEL OF LTHO WHEEL HUB UNDER TRANSPORT LOADS.	/7445
OISK LABEL:	LTHOFEM 4	
FILENAME	DESCRIPTION	5/26
TESTRING.*	TEST MODEL FOR LTHD SPEED SHIFT - ANNULAR PLATE LODDED ALONE ID AND SUPPORTED AT 3 POINTS ON OD (DISK 1 OF 2)	267493
DISK LABEL!	LTHOFEM 5	
FILENAME	DESCRIPTION	5,56
TESTRING.*	(OISK 2 OF 2)	355900

FELVIC	Northern Ordnance Minneapolis	Division
	Minneapolis	

TESTRNG2.*

APPLIED MECHANICS

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FILENAME	DESCRIPTION			:E
TESTRNG2.*	(015K 2 OF 3)		257	7046
<u>015K LABEL</u> :	LTHOFEM8			

(115K 3 OF 3)

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Volume in drive A is LTHDFEM1 Directory of A:\

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	GUNRAIL	. IS	260	1-28-87	2:26p	3	IBBAND	1:02	6958	1-16-87	10:12
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•	DEBAND	DXX	70	1-28-67	2:37p	3	DEEAND	RAN	260B	1-29-67	2:45
	DBBAND	FEF	6	1-28-87	2:51p	3	DEBAND	REA	1477	1-28-87	2:55
	DEBAND	GEO	2608	1-28-87			DBEAND	FINL	1696	1-28-87	2:51
1	OBBAND	IS	456	1-28-87	2:12p	3	OBBAND	SEO	2516	1-28-87	2:09
•	DEBAND	K01	114266	1-28-87			DREAND	STA	1 1	1-28-67	1:39
	DEBAND	K02	23876	1-28-87	2:48p	3	DBEAND	STL	70	1-28-57	2:39
•	DEBAND	LOD	2064	1-28-87			DBBAND	SXX	2516	1-28-67	2:37
•	DEBAND	NRM	25	1-28-87	2:48p	3					
		67 F1	le(s) 1	7408 byte	es free						
				•	•						

C:\IMAGES3D>

Volume in drive A is LTHDFEM2 Directory of A:\

CLAMPBAR BLK	42	1-30-87	B:45a 3 COLLAR2	DIO	16427	1-13-87	2:5
CLAMFBAR DES	60	1-30-87	8:28a 3 COLLAR2	DIA	1282	1-14-87	7:5
CLAMFBAR DIA	372	1-30-87	8:45a 3 COLLAR2	DIS	16424	1-14-87	8:0
CLAMFBAR DIS	15281	1-30-87	9:19a 3 COLLAR2	DOF	1236	1-14-87	7:5
CLAMPBAR DOF	1150	1-30-87	B:45a 3 COLLAR2	DSC	128	1-14-87	7:4
CLAMPBAR DSC	70	1-30-87	B:29a 3 COLLAR2	DUM	5 5	1-15-67	8:1
CLAMFBAR DXX	70	1-30-87	9:13a 3 COLLAR2	FEF	7	1-14-87	B: 0
CLAMPBAR FEF	6	1-30-87	9:19a 3 COLLAR2	G EO	4096	1-14-87	7:4
CLAMPBAR GEO	3380	1-30-87	8:28a 3 COLLAR2	IS	512	1-14-67	7:4
CLAMPBAR IS	666	1-30-87	8:31a 3 COLLAR2	K01	12696	1-14-87	7:5
CLAMPBAR KO1	14768	1-30-67	B:46a 3 COLLAR2	K02	12762	1-14-87	7:5
CLAMPBAR KOZ	7796	1-30-87	8:46a 3 COLLAR2	LOD	3200	1-14-87	7:5
CLAMFBAR LOD	2935	1-30-87	9:17a 3 COLLAR2	NEM	2 <i>6</i>	1-14-67	7:5
CLAMFBAR NRM	25	1-30-97	8:46a 3 COLLAR2	OVF	17	1-14-87	7:5
CLAMPBAR DVF	7	1-30-87	B:45a 3 COLLAR2	FLO	66521	1-13-67	3:1
CLAMPBAR RAN	3380	1-30-87	8:45a 3 COLLAR2	FLS	66581	1-14-87	8:1
CLAMPBAR RNL	1360	1-30-87	5:19a 3 COLLARD	RAN	4096	1-14-37	7:5
CLAMPBAR SEC	2889	1-30-87	8:28a 3 COLLARC	REO	2053	1-13-87	3:1
CLAMFBAR STA	11	1-30-87	9:17a 3 DCLLAR2	REA	2023	1-14-67	E:1
CLAMPBAR STL	7 0	1-30-87	9:17a 3 COLLARC	FNL	2369	1-14-87	8: d
CLAMPBAR SXX	2889	1-30-37	9:13a 3 COLLAR2	SEO	3712	1-14-67	7:4
COLLAR2 BLK	42	1-14-87	7:57a 3 COLLAR2	STA	128	1-14-E7	7: 5
COLLAR2 DES	128	1-14-87	7:44a 3 CCLLARI	STL	128	1-14-87	7: 5
46 File	(s)	55296 byte	s free				1

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Volume in drive A is LTHDFEM3 Directory of A:\

٠,										
	LTHDHUBA	BLK	24	2-25-87	1:56p	TPMANFLD		70	2-17-87	
	LTHDHUBA		60	2-25-87	1:50p	TPMANFLD		6	2-17-87	
	LTHDHUBA		200	2-25-87	1:56p	TPMANFLD		B996	2-17-87	
	LTHDHUBA			2-25-87	1:58p	TPMANFLD		1506	2-17-87	
	LTHDHUBA		_	2-25-87	1:56p	TPMANFLD		14882	2-17-87	
	LTHDHUBA			2-25-87	1:50p	TPMANFLD		14532	2-17-87	
	LTHDHUBA			2-25-87	1:58p	TPMANFLD		14646	2-17-87	
	LTHDHUBA		1124	2-25-87	1:50p	TPMANFLD		14500	2-17-87	
'n	LTHDHUBA		127	2-25-87	1:51p	TPMANFLD	K05	14508	2-17-87	
	LTHDHUBA		5872	2-25-87	1:56p	TPMANFLD	K06	3970	2-17-87	
•	LTHDHUBA		1206	2-25-87	1:55p	TPMANFLD	LOD	6551	2-17-87	
	LTHDHUBA		25	2-25-87	1:56p	TPMANFLD	NRM	25	2-17-87	
	LTHDHUBA		7	2-25-87	1:56p	TPMANFLD	DVF	7	2-17-87	
i	LTHDHUBA		1124	2-25-87	1:56p	TPMANFLD	RAN	8996	2-17-87	
	LTHDHUBA		688	2-25-87	1:58p	TPMANFLD	RNL	184	2-17-87	
	LTHDHUBA		1102	2-25-87	1:50p	TPMANFLD	SEQ	B540	2-17-87	11:12a
	LTHDHUBA		11	2-25-87	1:55p	TPMANFLD	STA	11	2-17-87	
•	LTHDHUBA		132	2-25-87	1:55p	TPMANFLD	STL	70	2-17-87	
	PMANFLD		114	2-17-87	11:35a	TPMANFLD	SXX	7343	2-17-87	
N	MANFLD		60	2-17-B7	11:11a	TRAILDIA	BLK	24	2-11-87	7:25a
Ü	TPMANFLD		888	2-17-87	11:35a	TRAILDIA	DES	60	2-11-87	7:19a
	TPMANFLD		34697	2-17-87		TRAILDIA	DIA	266	2-11-87	7:25a
4	TPMANFLD		2614	2-17-87		TRAILDIA	DIS	7661	2-11-87	7:27a
	TPMANFLD		70	2-17-87		TRAILDIA	DOF	310	2-11-87	7:25a
		ress	any key to	continue	· ———	ļ				1
_	TRAILDIA		82	2-11-87	7:19a	TRAILDIA	OVF	7	2-11-87	7:25a
	TRAILDIA		70	2-11-87	7:14a	TRAILDIA	RAN	1244	2-11-87	7:25a
•	TRAILDIA		12	2-11-87	7:27a	TRAILDIA	RNL	2032	2-11-87	7:27a
	TRAILDIA		1244	2-11-87	7:19a	TRAILDIA	SEQ	1090	2-11-87	7:19a
	TRAILDIA		183	2-11-87	7:20a	TRAILDIA	STA	11	2-11-87	7:24a
•	TRAILDIA		18002	2-11-87	7:26a	TRAILDIA	STL	318	2-11-87	7:24a
	TRAILDIA		4224	2-11-87	7:24a	TRAILDIA	SXX	880	2-11-87	7:13a
Ţ			25	2-11-87	7:26a	}				\
۲.				1376 byte		•				
٠.	_									

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LTHOFEM4

Directory of A:\

_	17	. File	· (=)	87040 byte	- 4						
	TESTRING	FOR	125334	2-16-87	B: 4⊜a	.3					
5	TESTRING	1.01	110578	2-16-67			TESTRING	STL	70	2-16-87	8:050
	TESTRING TESTRING	15	1338	2-16-87	8:02a	3	TESTRING	ATR	11	2-16-87	€:೧೮೩
	TESTRING		7044				TESTRING		7921	2-16-87	7:562
	TESTRING		70	2-16-87	7:56a	3	TESTRING	RAN	7044	2-16-67	8:31a
	TESTRING		2204	2-16-87					25	2-16-87	8:42a
	STRING		60						5834	2-16-57	B: OFa

C:\images3d>ddir a:

Volume in drive A is LTHDFEM5 Directory of A:\

			<u>5</u>)								
ď	TESTRING	K03	126382	2-16-87	8:41a	3					
	TESTRING							RNL	3544	2-16-87	8:47a
_	TESTRING						TESTRING		7	2-16-67	8: 34a
	TESTRING						TESTRING		66850	2-16-87	8:42a
	TESTRING						TESTRING		126390	2-16-87	6: 41a

্ৰৈ C: Vimages3d>

C:\images3d>ddir a:

Volume in drive A is LTHDFEM6 Directory of A:\

5-11-B7 9:07a	TESTRNG2 LOD	6404	3-05-87	11:11a
		25	3-11-87	10:03a
	TESTRNG2 RAN	7792	3-11-87	9:51a
	TESTRNG2 SEQ	9461	3-11-87	9:08a
	· · · · · · - · - ·	11	3-05-87	11:11a
	1	70	3-05-87	11:11a
	1			
	3-11-87 9:51a 5-11-87 9:08a 5-11-87 9:07a 5-11-87 9:14a	TESTRNG2 NRM TESTRNG2 RAN TESTRNG2 SEC TESTRNG2 SEC TESTRNG2 SEC TESTRNG2 SEC TESTRNG2 STA TESTRNG2 STA TESTRNG2 STA TESTRNG2 STA TESTRNG2 STA TESTRNG2 STA TESTRNG2 STL	3-11-B7 9:51a TESTRNG2 NRM 25 3-11-B7 9:08a TESTRNG2 RAN 7792 3-11-B7 9:07a TESTRNG2 SEQ 9461 3-11-B7 9:14a TESTRNG2 STA 11 3-11-B7 10:00a TESTRNG2 STL 70 3-11-B7 10:01a	S-11-B7 9:51a TESTRNG2 NRM 25 3-11-B7 5-11-B7 9:08a TESTRNG2 RAN 7792 3-11-B7 5-11-B7 9:07a TESTRNG2 SEQ 9461 3-11-B7 5-11-B7 10:00a TESTRNG2 STA 11 3-05-B7 5-11-B7 10:01a TESTRNG2 STL 70 3-05-B7

્રિ તેરું C:\images3d>ddir a:

Volume in drive A is LTHDFEM7 Directory of A:\

TESTRNG2 KO3 128316 3-11-87 10:01a | TESTRNG2 KO4 128730 3-11-87 10:02a 2 File(s) 104448 bytes free

C:\images3d>ddir a:

Volume in drive A is LTHDFEM8 Directory of A:\

TESTRNG2 BLK TESTRNG2 DIS TESTRNG2 DOF TESTRNG2 DXX TESTRNG2 FFF	31586 2552 70	3-11-87 3-11-87 3-11-87	11:14a 9:53a 8:49a	TESTRNG2 KO5 TESTRNG2 KO6 TESTRNG2 DVF TESTRNG2 RNL TESTRNG2 SXX	53566- 7 3880	3-11-87 3-11-87 3-11-87 3-11-87 3-11-87	10:03a 9:53a 11:14a
TESTRNG2 FEF		3-11-87 26976 byte		TESTRNG2 SXX	9177	3-11-87	8:49a

C:\images3d>

\images3d>ddir a: Volume in drive A is LTHDHUB1 Directory of A:\ LTHDHUB 222 BLK 2-25-87 8:57a 3 LTHDHUB KO1 91924 2-25-87 9:10a DES LTHDHUB 60 2-25-87 7:16a 3 LTHDHUB LOD 17678 2-25-87 7:41a 8:55a 3 LTHDHUB LTHDHUB DIA 3324 2-25-87 NRM 25 2-25-87 9:17a ⁹⁵¹ LTHDHUB DIS 9:47a 3 LTHDHUB 88115 2-25-87 OVF 2-25-87 B: 57a 8:57a 3 LTHDHUB LTHDHUB DOF 3552 2-25-87 RAN 11656 2-25-87 8:55a 7:16a 3 LTHDHUB 3 LTHDHUB DSC 70 2-25-87 SEQ 14125 2-25-87 7:16a ETHDHUB DXX 70 2-25-87 7:12a 3 LTHDHUB STA 2-25-87 11 7:42a LTHDHUB GEO 11656 2-25-87 7:16a 3 LTHDHUB STL 2-25-87 132 7:42a , LTHDHUB IS 2-25-87 7:27a 3 LTHDHUB SXX 2045 13944 2-25-87 7:12a 18 File(s) 91136 bytes free Volume in drive A is LTHDHUB2 Directory of A:\ LTHDHUB KO2 127006 2-25-87 9:10a 3 LTHDHUB KO3 125966 9:11a 2-25-87 2 File(s) 107520 bytes free Volume in drive A is LTHDHUB3 irectory of A:\ LTHDHUB KO4 126876 2-25-87 9:12a 3 LTHDHUB KO5 126966 2-25-87 9:13a 2 File(s) 108544 bytes free Volume in drive A is LTHDHUB4 Directory of A:\ LTHDHUB KO6 125894 2-25-87 9:13a 3 LTHDHUB K07 126616 . 2-25-87 9:14a 2 File(s) 109568 bytes free Volume in drive A is LTHDHUB5 Directory of A: \ LTHDHUB KOB 125666 2-25-87 9:15a 3 LTHDHUB K09 126918 2-25-87 9:16a 2 File(s) 109568 bytes free Volume in drive A is LTHDHUB6 Directory of A:\

9:47a 3 LTHDHUB

9:17a 3

9:16a 3 LTHDHUB RNL

K12

32806

16480

2-25-87

2-25-87

9:17a

9:47a

C:\images3d>

LTHDHUB K10

LTHDHUB K11

FEF

5 File(s)

12

126942

123334

2-25-87

2-25-87

2-25-87

59392 bytes free

LTHDHUB

PART NUMBERS: 12585781-001, -002, -003, -004, Collar Machining

12586036-001, Collar Forging

DESCRIPTION: COLLARS

STATUS:

TOTAL PROPERTY AND A STREET

CONTROL BUTTON OF BUTCH STATES

Dimensions and tolerances for the collar machining (TDP, Dwgs. 12585781-001, -002, -003, -004, -005) and forging drawings (TDP, Dwg. 12586036-001) have been determined and are supported by extensive analysis. Analysis indicates that acceptable factors of safety are obtained for various worst-case conditions with TI6AL4V used for the rear collar set and 6061 Al/20 v/o SiCp for the remaining collars. The collars have several worst-case load conditions which were analyzed separately: rifling torque, thermal stress, recoil thrust and barrel expansion. A complete summary of analysis results and the supporting calculations are found in the following pages of this section.

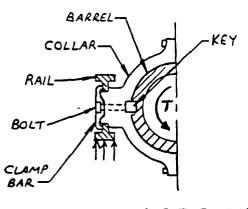
AUTHORS: Joe Fishbein, Joe Turek, Scott Dacko

COLLARS

The collars attaching the rails to the barrel have several loading conditions, which were analyzed separately.

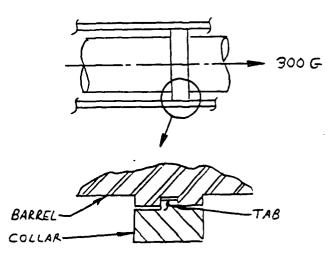
- 1) Rifling Torque This load is carried from the barrel to the manifolds through the collar ends in shear. Keys were used at the barrel/collar and collar/rail connections. A Finite Element model of a section through the collar end was made to evaluate these stresses. Since this analysis was performed, the collar end geometry has changed significantly. New analysis has not been performed, but the critical areas that were examined in the original geometry have been eliminated with the new geometry.
- 2) Thermal Stress The collars were analyzed for hoop stress due to thermal loads. The extreme condition is a 400-deg. F. barrel temperature, and a -25-deg. F. ambient temperature. Resulting stresses are 33,117 PSI for the AlSiC collars, and 58,104 PSI for the steel collar. This is an extremely conservative analysis, as it neglects the air space between the barrel and collars.
- 3) Recoil Thrust under firing conditions, the barrel will recoil with a maximum acceleration of 300 G. The inertia of the collar/rail assembly, weighing 368 lb., is resisted by internal tabs on the breech end collar that engage a slot on the barrel. Shear and bending stresses in these tabs are low (9,200 PSI and 14,490 PSI, respectively).
- 4) Barrel Expansion The steel collar and barrel were analyzed as concentric cylinders under 62,900 FSI internal pressure, similar to the analysis of the muzzle brake. Maximum hoop stress in the collar is 39,194 PSI (FS=3.06).

The AlSiC collars contact the barrel only at the keys. They were analyzed as a ring with forced outward displacements at opposite points. A simple FEM was used, and the resulting stresses were low (1,778 PSI tensile, 5,634 PSI bending).



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GEOMETRY

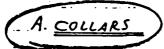


RECOIL LOADING

2

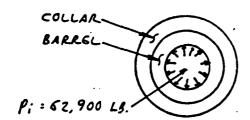
GNF 2/16/87 1 OF1

SUMMARY OF LOADS USED IN ANALYSIS

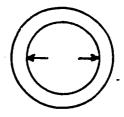


- 1. RIFLING TORQUE 48,000 FT-LB.
- 2. THERMAL STRESS INSIDE TEMPERATURE: +400°F.
- 3. <u>RECOIL THRUST</u> 300 G ACCELERATION, RESISTED
 BY WEIGHT OF COLLAR/RAIL
 ASSEMBLY (358 LB.)
- 4. BARLEL EXPANSION BARREL INTERNAL PRESSURE = 62,900 LB.

STEEL COLLAR AWALYZED AS CONCENTRIC CYLINDERS. AISIC COLLARS AWALYZED AS RING WITH POINT RADIAL LOADS AT KEYS.



STEEL COLLAR



ANALYZGE AS ENFORCED DISPLACEMENT, WITH A DETERMINED BY EXPANSION OF BARREL ONLY.

AISIC COLLAR

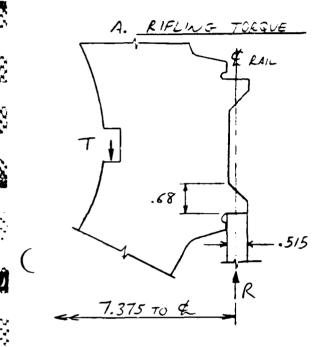




Subject	Analyst	JMZ
LTHP	Project Number	
2111	EC. No.	Dete 2 20.9-



RE-CHECK COLLARS



$$R = \frac{(48,000)(12)}{2(7.375)} = 3905/16$$

MATCRIAL	Ty (KSI)	F5
4340 STEEL	120	6.33
TITANIUM	/20	6.35
6061-A1/20V/0 5.C1	60	3.17

SHERR ACROSS PROJECTION

MAT'L	.5857 (Ks)	F5
4340	69.6	4.85
T;	69.6	4.85
AIS:C	34.8	2.42

Sheet ___Of ___

DA-649Oct85

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APPLIED MECHANICS

LTHD

Subject

Analyst

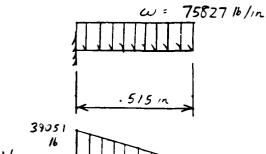
Project Number

EC. No.

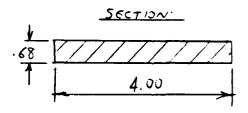
Dete
2.20: \$7



BENDING ON PRUTECTION







 $A = 2.72 \, m^2$ $I = .1048 \, m^4$ $5 = .3083 \, m^3$

10056 m./b = 32621 psi

MATIL	Γy	FS
4340	120	3.68
T;	120	3.68
A15.C	60	1.84

LTHD

Project Number

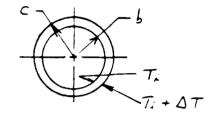
EC. No. Quite 2.20.8-



B. THERMAL STRESS (REF: ROARK, 54h co, p. 525)

FUR 15- COLLAR

6 = 5.88 in A===x.



MATIL	E	×	~
4340 TECL	29×106 psi	6.6 × 10 -6 of -1	•3
TITALIM	16 × 106 ps	5.0 × 10 -6 ° F 1	.3/
AIS;C	15 × 10 6 pg	9.0×10-6°F-1	.3

MATIL	OUTER TT	INNER JT	F5
4340	-13152	-14190	8.46
T;6A14V	- 5577	- 6017	19.94
6061A1 20V/05	G -9277	-10009	5.99

Northern Ordnance Division Minneapolis

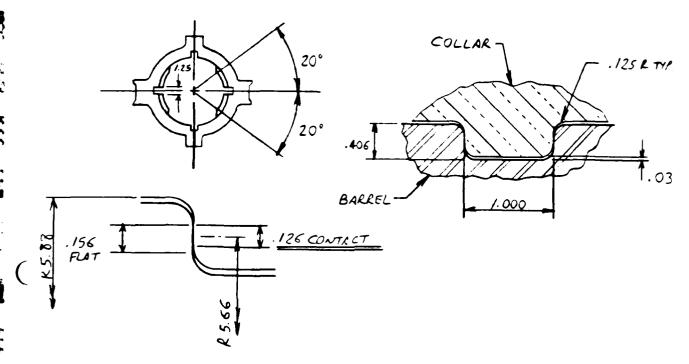
APPLIED MECHANICS

LTHO

		IVIE			
Analyst	9177				
Project Numb	101				
EC. No.		Dete 7.27 77			



C. RECOIL THRUST



LENGTH # TRB =
$$2\pi (566,n) \left(\frac{80^{\circ}}{360^{\circ}}\right) = 2(1.25) = 5.4035,n$$

CONTACT AREA . (5.4055 2) (.126) = .68/ 12

MAX. BARREL ACCELERATION = 438G (105% PIMP) - PER S. DECKS 2/25/87

USE DRIGINAL WEIGHT (368 16) FOR COLLAR/RAIL ASS'Y.

P max . (368 %) (438 G) = 161,184 %

 $\sqrt{b_{r_3}}$, $\frac{161, 184 / 5}{681 m^2}$, 236,690 psi $\frac{F5 = 0.5}{}$

CONSIDER MAKING TARS CONTINUOUS BROWNS COLLAR

Sheet ___01 ___

Subject

LTHD

Analysi 3177
Project Number Date

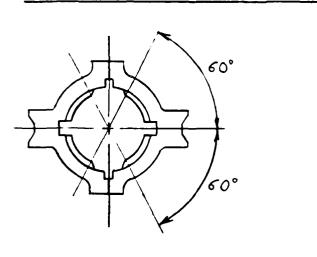


CONTINUES TARS

$$\sqrt{b_{13}} : \frac{161,184 \, k}{3.9769 \, n^2} = 40,530 \, ps; \quad F5 = 2.96$$

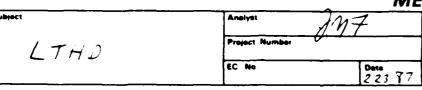
MINIMUM ANGLE FOR FS = 2.00

MINIMUM TAB ANGLE = \$ 600



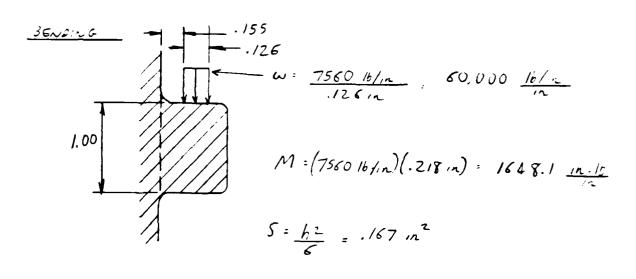
Sheet ___01___

DA-649Oct85



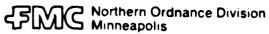
UNITLORD ON TAB: 101, 184 16 = 7560 16/12

SHCAR 7: 7560 16/12 . 7560 psi F5 = (.58)(1200) . 9.2



To: 11/5: 9888 psi <u>F5 = 12.14</u>

Sheet ___Of ___



APPLIED MECHANICS

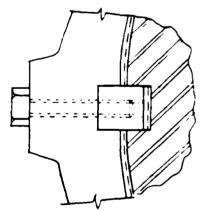
Analyst	9177
Project Number	
EC No	Dete 2 23 77
	Project Number



D. BARREL EXPANSION

$$\Delta a = \frac{4}{E} \frac{2ab^2}{a^2 \cdot b^2} = .0106 \text{ in}$$

THIS IS LOSS THAN KEY CLEARANCE, SO COLLARS WILL SEE NO STRESS DUE TO BARREL EXPANSION



Northern Ordnance Division Minneapolis

APPLIED MECHANICS

LTHD

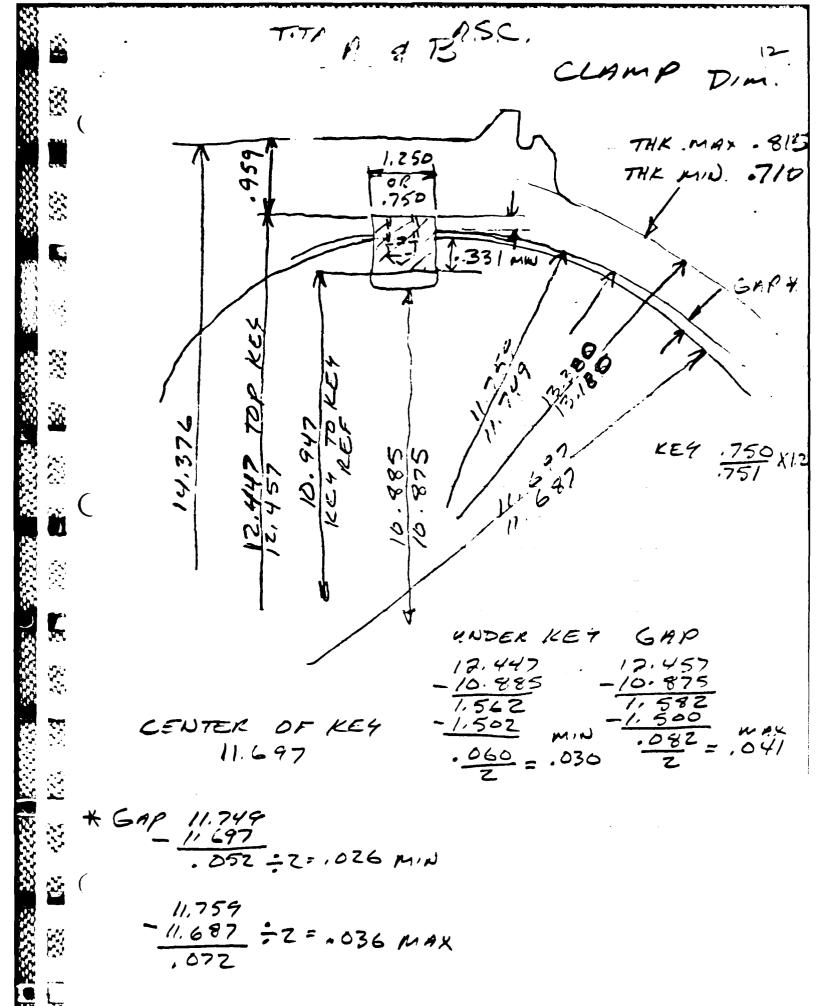
Analyst

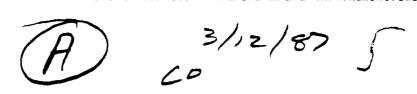
Project Number

EC. No. | Date



BARREL COLLAR "A" (CONTINUED)





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CONTACT . 126

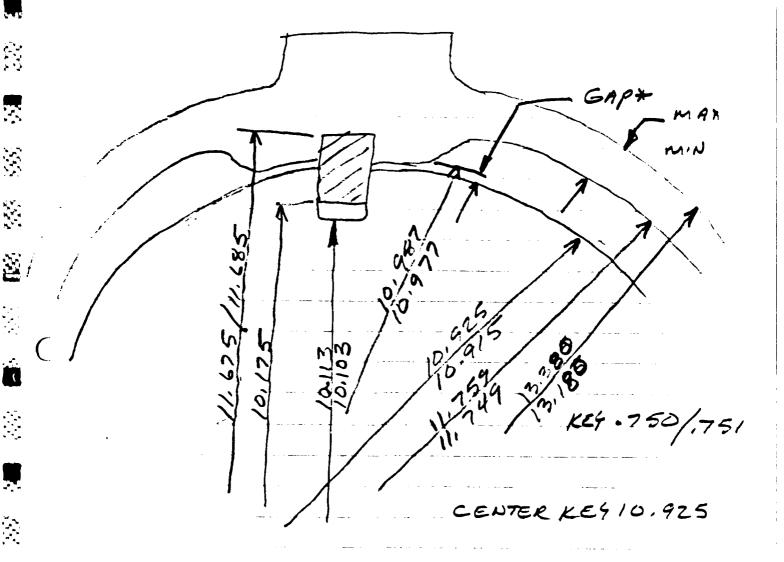
+ 16,495 16,445 min .9995 -16,875 10.885 MAX 1,0005

GAP MAX.060 MIN.030 PER SIDE

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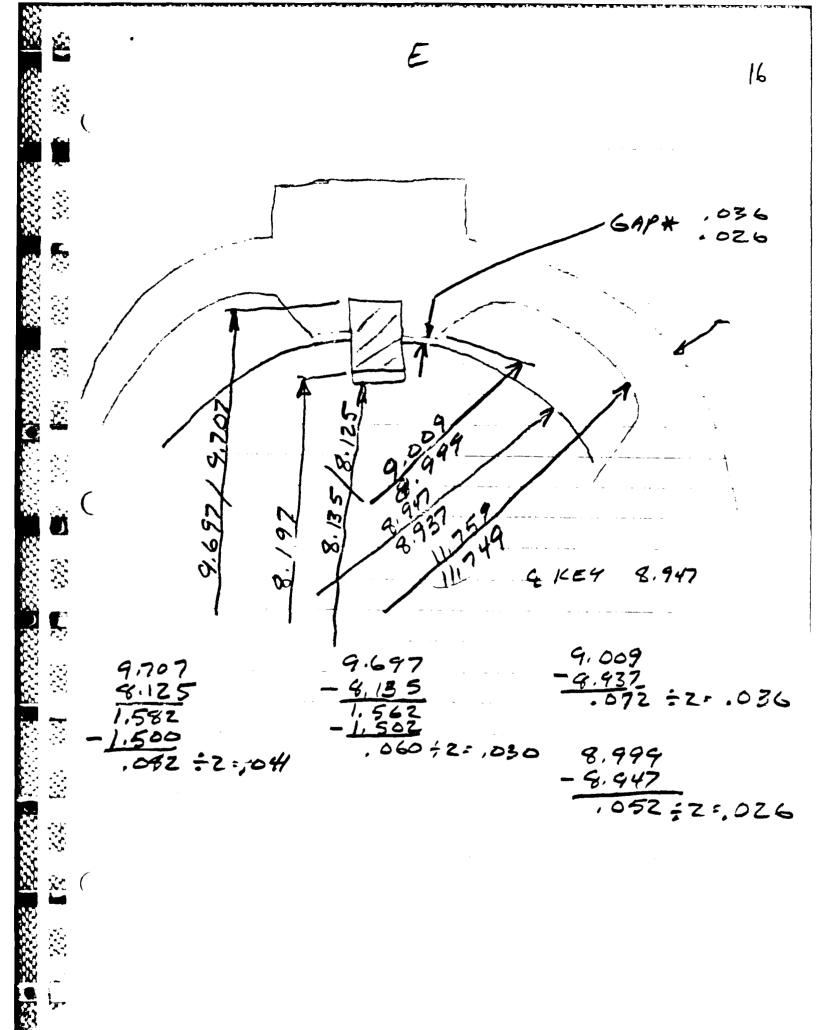
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.072 = 2= .036 MAX -2= .026

GAPX 710 10.821 10.123

10.051 .072 = .036 *

10.113 10.061 .052 - Z = .026 * - 9.239 1.582 -1.500 UNDER KEY 82 ÷2=.04/ MAX 10.811 - 9.249 PER SIDE 1.562 -1.502 60 ÷2 =.030 MID

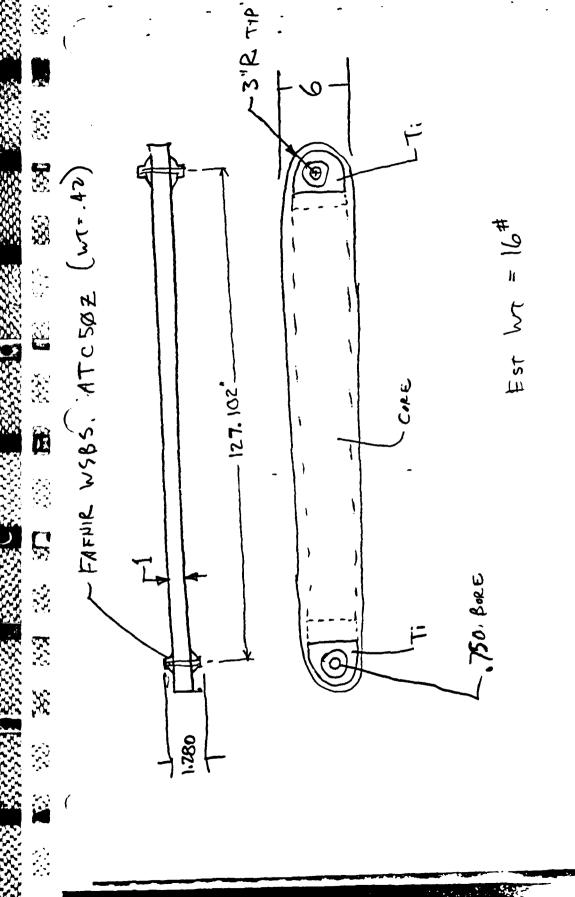


DESCRIPTION: EQUILIBRATION LINK ASSEMBLY

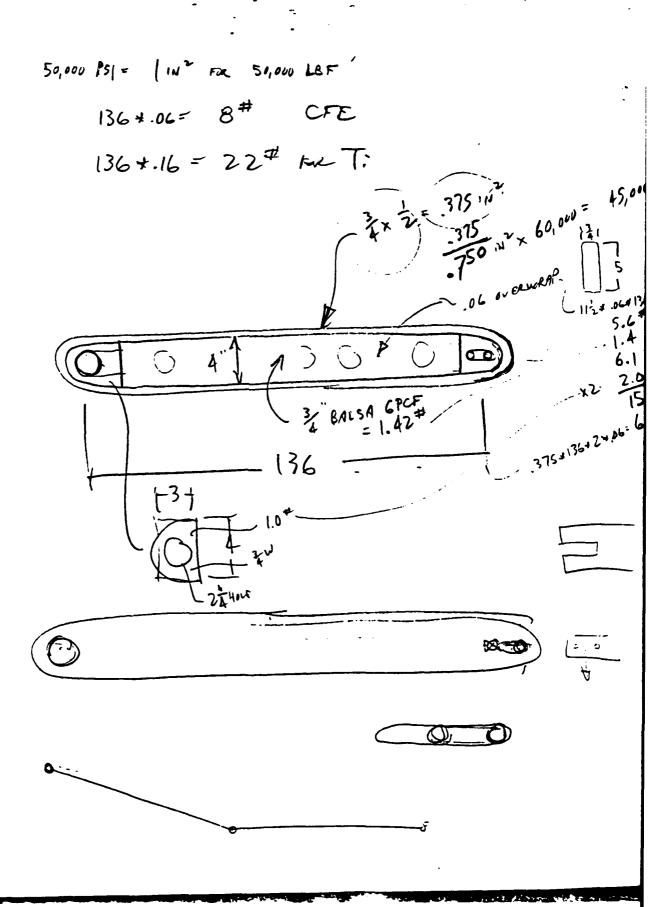
STATUS:

The equilibration link assembly was changed from a cable and pulley configuration to a rigid composite link configuration because of space problems caused by the large pulleys required for the cable. The sketches on the enclosed pages describe the current configuration.

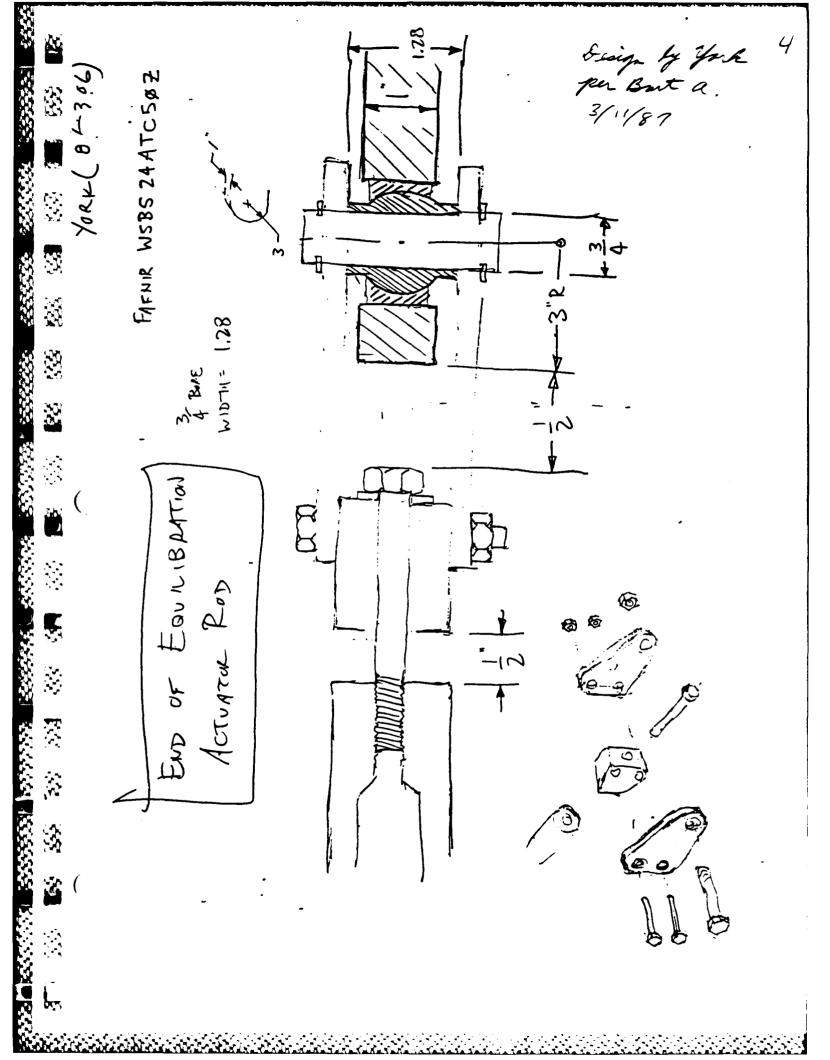
AUTHOR: BART ANDERSON



DESIGN LOAD IN TENSION - 50,000 UBF



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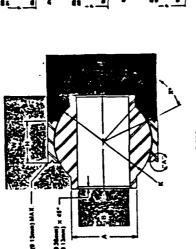
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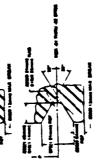
1

Z Extended Series

- Spherical type
- Operating temperature range = 85°F to +250°F (-53 0°C to 121 1°C)







LOAD RATINGS

DIMENSIONS . TOLERANCES

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FAFNIR

PART NUMBER: 12585710-400, Fire Control and Optics

DESCRIPTION: FIRE CONTROL TRUNNION AND LINKAGE

Major components to be discussed include: actuator strut, side support struts, top support struts, bell crank, end caps, trunnion tube, torque beam and arm, X-brace and direct fire scope. Major areas of analysis include: design load determinations, linkage adjustability and alignment requirements. A summary of calculated design loads including damage tolerance loads is found in the following pages of this section.

Overview. A four-bar, parallelogram linkage design was developed to allow the QE at the cradle trunnion to be matched at a secondary, fire control trunnion. By maintaining a length delta between both sets of parallel links of less than .001 inch, alignment error between trunnions will not exceed 0.24 mils, as indicated in the Alignment Error vs. Quadrant Elevation graph in Figure D/130-1. Furthermore, to achieve the required alignment and allow easy assembly and maintainability, adjustability is designed into the actuator strut and bell crank.

Struts. All fire control struts are fiber-wrapped graphite epoxy with titanium end-pieces. Graphite-epoxy was chosen as a common strut material because of its very low coefficient of thermal expansion. This eliminates the introduction of alignment error due to temperature-induced changes in strut lengths. actuator strut has pre-loaded Fafnir bearing rod ends threaded into the Ti end-pieces to provide strut length adjustability. Locking nuts hold the rod ends in place. The side and top support struts are similar in construction, the exception being that only the strut ends attaching to the gimbal use Fafnir The strut ends at the fire control trunnion house bearings. Kaydon bearings, which in turn house the fire control trunnion endcaps. The side support struts provide the mounting surfaces for the tube lay controls, which are mounted on the outer sides of these struts and approximately midway up.

Bell crank. Length adjustability is also required in this part to .001 inch from the fire control trunnion tube centerline to the point of actuator strut attachment. The layouts describe the adjustment method. Material is also GrEp to resist temperature-induced length changes.

End caps. Aluminum or Al/SiC end caps provide precision mounting surfaces for the pre-loaded Kaydon bearings housed in the top and side support struts. The end-caps are adhesively bonded to the trunnion tube at assembly with a tie-rod-like fixture that pushes and aligns the two end-caps on the trunnion tube. The adhesive is relied upon to prevent galvanic corrosion problems. The direct fire equipment mounts on the face of the right end cap and the indirect fire equipment mounts on the face of the left end cap. End cap hole patterns are identical to those found on the

M198 left and right trunnions. Although hole pattern dimensions are dimensioned as if the left and right end caps are mirror images, the dimensions are such that the end caps can be considered identical.

Trunnion tube. The trunnion tube is of fiberglass or fiber-wound graphite epoxy construction. The not-yet-finalized wall thickness is to be sized for the identified damage tolerant load conditions.

Torque beam and arm. Construction of both the torque beam and arm is similar to that of the other struts. The structure must be capable of transmitting the 2000 lb load from the indirect fire scope shock absorber to the gimbal.

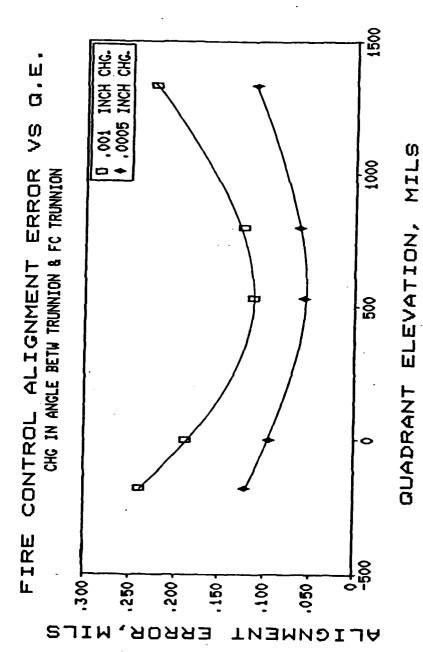
X-brace. A X-brace configuration between the two top support struts is required to maintain sideways stability. Load cases determining the X-brace shape are primarily damage tolerant and not related to firing loads.

Direct-fire scope. A modified M198 direct fire or elbow telescope (TDP, Dwg. 12585970) is used with the LTHD. The current fire control trunnion height dictates that the look inclook out distance of this scope be a minimum of 6.125 inches. The current fire control trunnion distance from the gimbal suggests that the scope would be easier for the assistant gunner to use if the eye piece were angled 30 degrees further from the current 90-degree bend. For a further discussion, see the direct fire scope trade study presented in the trade study section of this report.

STATUS:

Layouts of the fire control trunnion and linkage design were created. The 1/12 scale layouts of this design that were provided to a model shop can be found in the TDP, Dwg. No. 12585710-400. Better sizing of some components is still required.

AUTHORS: Scott Dacko, Ron Larson, Bart Anderson



17.7.50

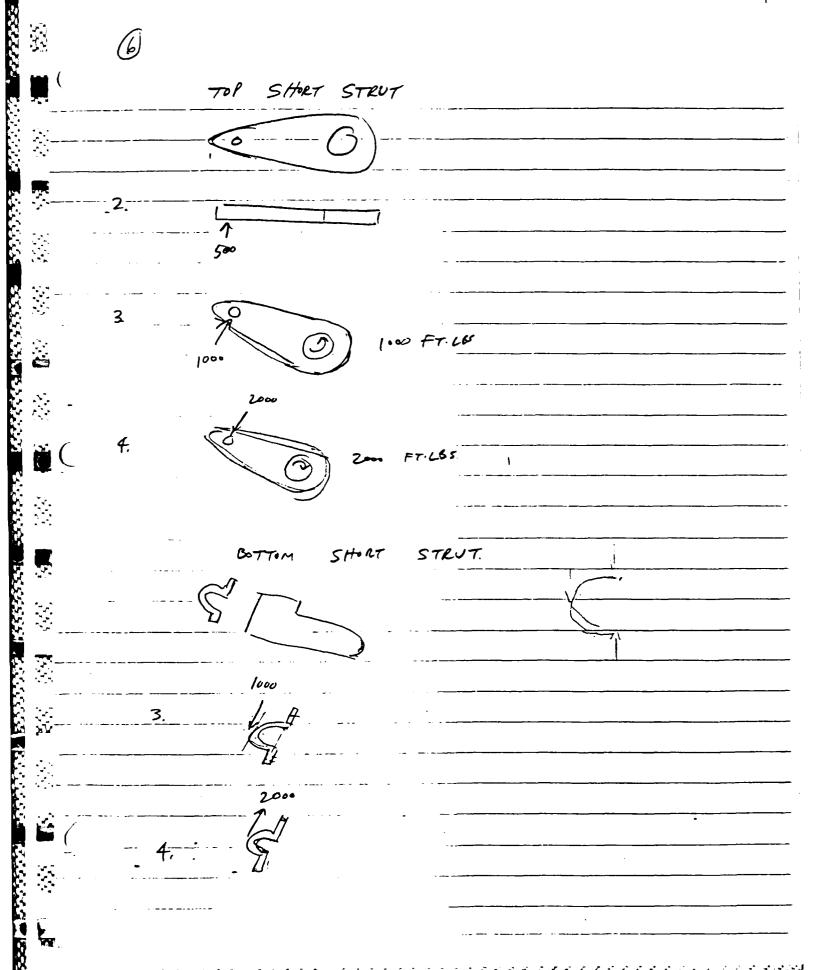
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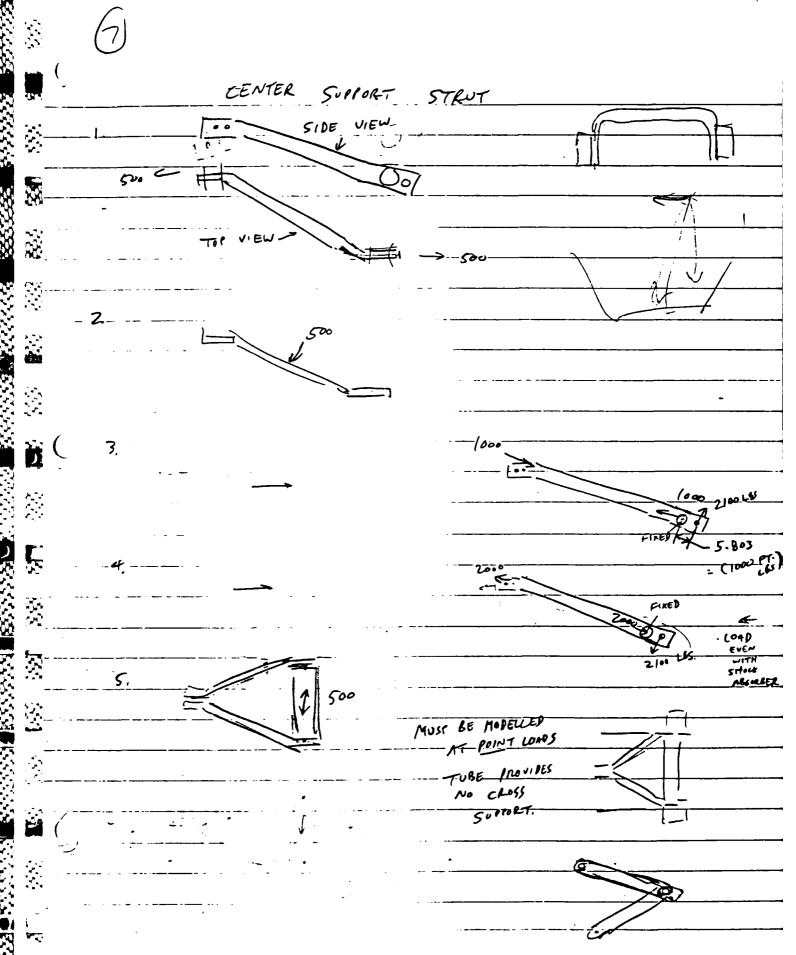
STATES NECESSARY DOCUMENT

F160RE D/130-1.

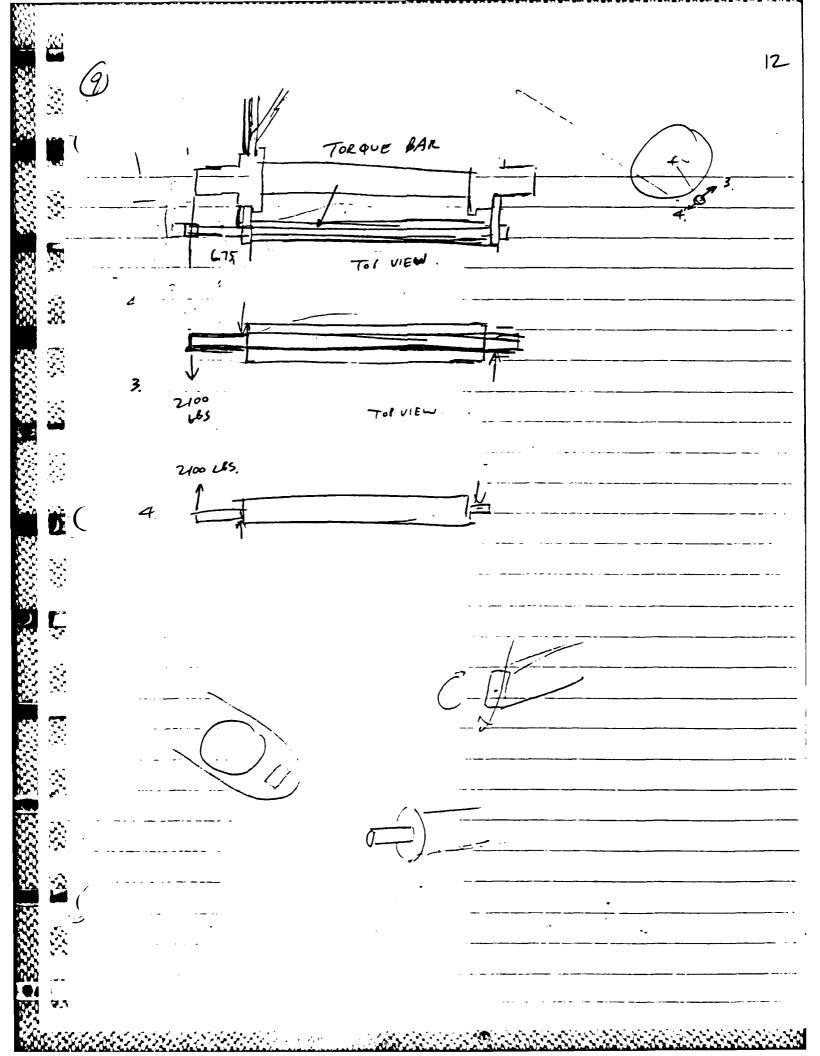
	5. DACKO - 2/10/87
1 (FILE CONTROL LINEAGE
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-	1.2 MEN HANGING ON MIDDLE OF TRUNNION TUBE ON WIX
5	2. 500 LB LOAD I TO SIDE STRUTS & ACTUATION STUTY
	3. 10 G RECOIL LOAD AT 0° GE + TRAN STANT
X	4. 20 6 BOONCE OFF ROCK" COMO AT O OF TRAV.
	5, 2 MEN 15ting SIDEWAYS ON TRUNNIAN TUBE, QUICKLY.
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Al/Sic END CAPS.	
3- FT. LBS	500 FT. LSI
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	1000 FT.LSS
4. 2000 FT 1 BS	1000 FT-18
TOP VIEW	
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400 FT. LM.	
& BUEL	
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PART NUMBERS: 12585810, gimbal weldment,

12585811, gimbal machining

DESCRIPTION: GIMBAL

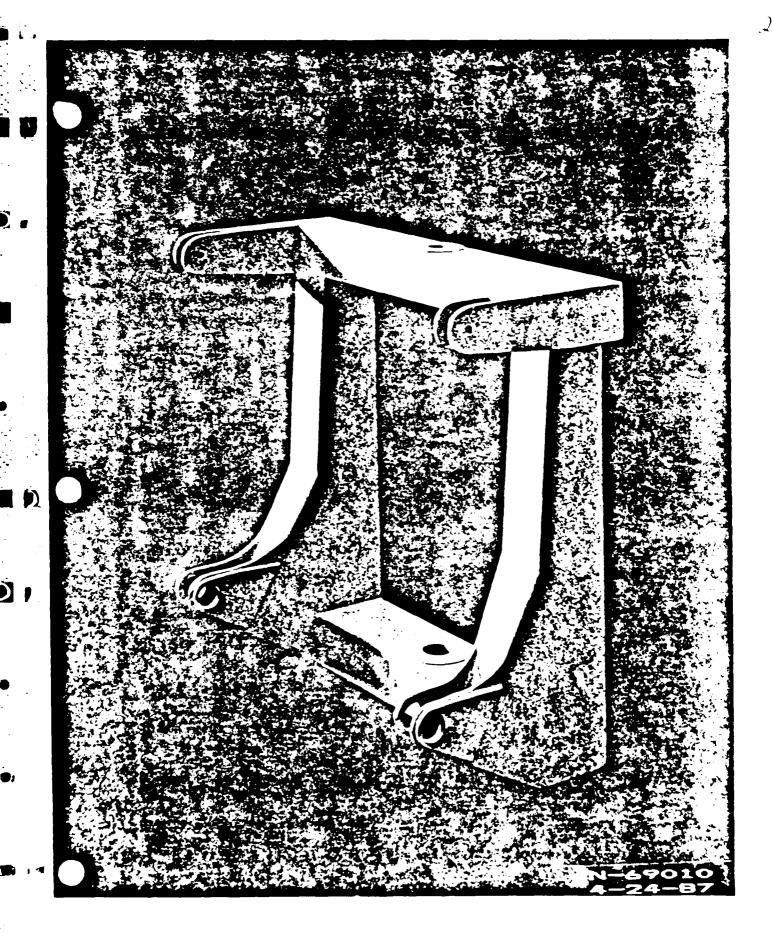
The gimbal is a machined titanium weldment whose weight is 244 lbs. Frimary interfaces include: the upper and lower sections of the platform via Torrington bearings; the cradle at the trunnion; the equilibration rods at two locations: the elevation cylinder at one location and the traverse cylinder at one location. The complete fire control linkage also connects to the trunnion, but the reader is referred to Appendix Y for a discussion of these load cases.

STATUS:

All design and drawing requirements for the gimbal have been completed. Drawings for the gimbal can be found in the TDP.

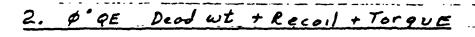
Efforts to date have been to minimize the weight of the gimbal by generating an optimum configuration through the use of FEA models and hand calculation. Further weight reductions were envisioned by planned structural testing. A summary of loading conditions and design calculations can be found on the following pages of this section.

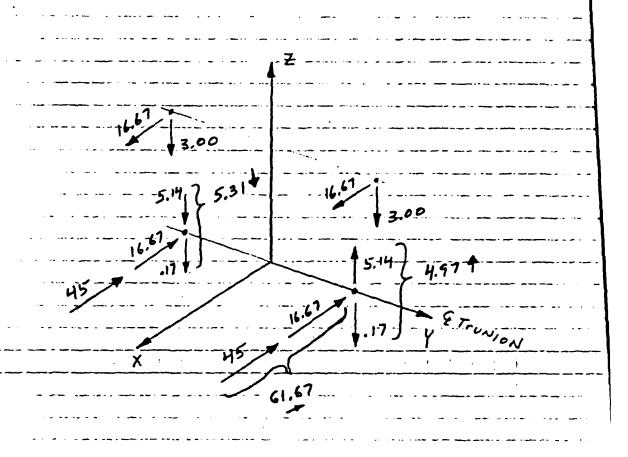
AUTHORS: Fatty Yelich, Dave Langerud



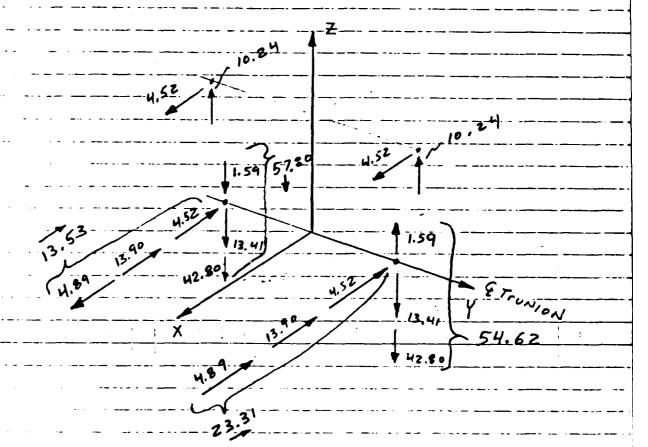
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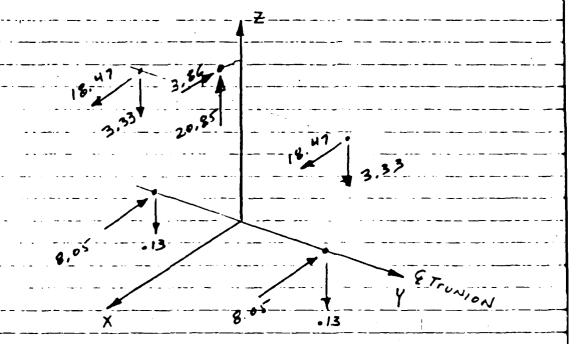


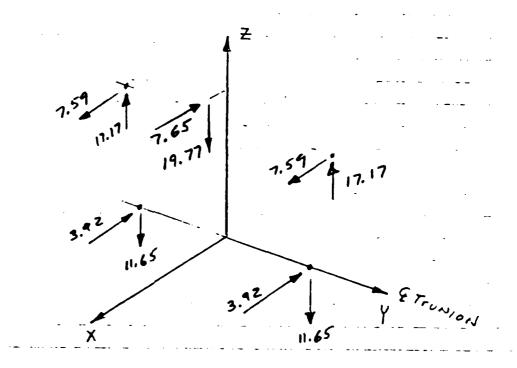
202.8 = 5.14 39.44

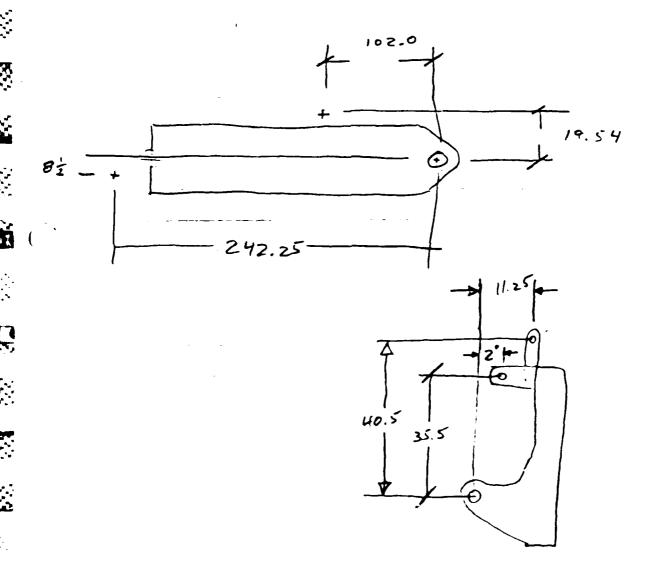


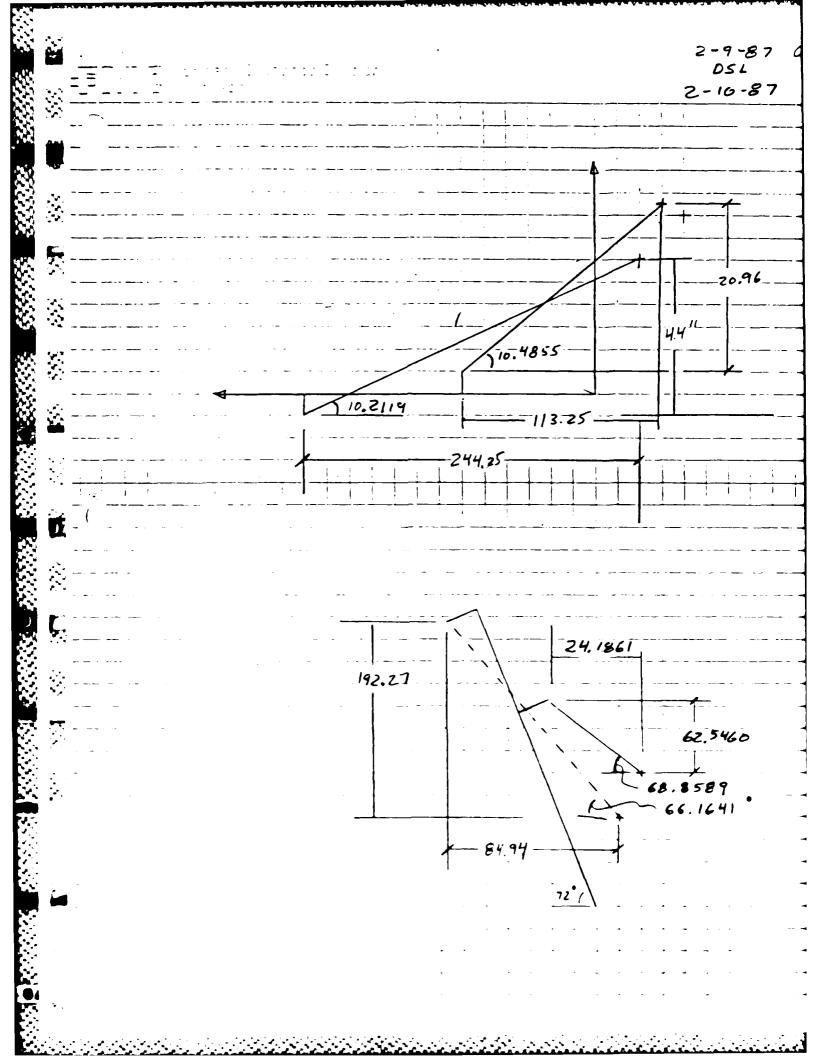
(90 cm 72)/2 = 42.80(90 con 72)/2 = 13.90

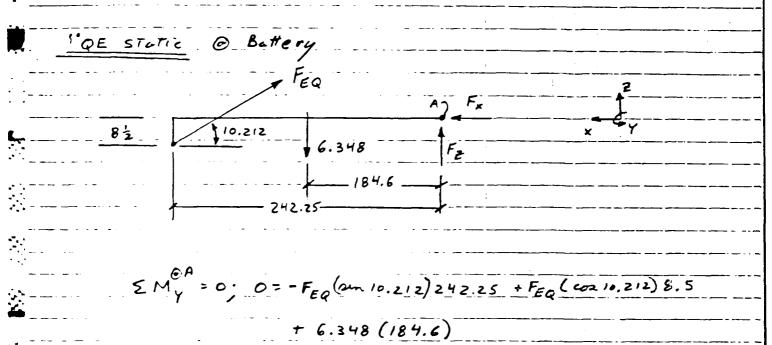
(202.8 am 72)/39.44 = 4.89 (202.8 coe.72)/39.44 = 1.59 \$ OE @ LOAD & Depress









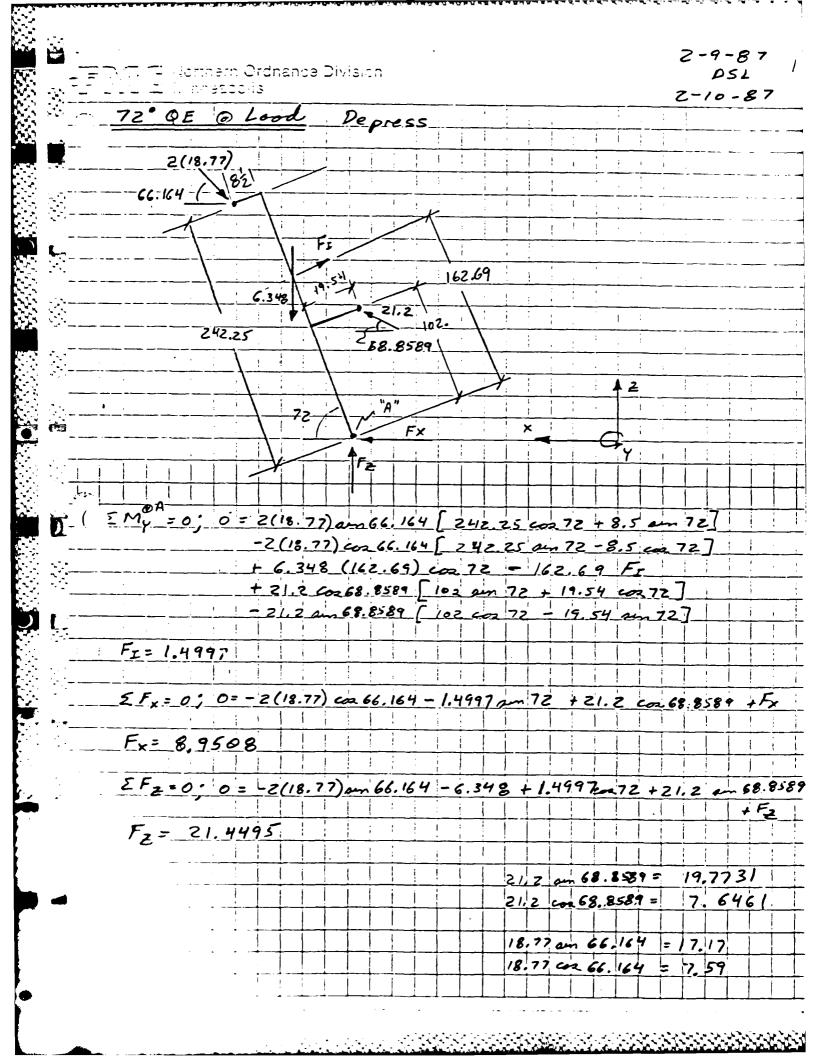


$$F_{EQ} = 33.88 \text{ Kp} \qquad (16.94 \text{ Kp/sade})$$

$$EF_{X} = 0; \quad 0 = F_{X} - 33.88 \text{ cos } 10.212$$

$$F_{X} = 33.34 \text{ Kp} \qquad (16.67 \text{ Kp/side})$$

V = 16.94 am 10.212 = 3.003 H= 16.94 co2 10.212 = 16.672



Morthern Ordnance Division Depress 162.69 6.348 242.25 59.6059 FX EMy = 0; 0 = 2(18.77) am 66.164 [242.25 con 72 + 8.5 am 72] -2 (18.77) con 66. 164 [242.25 ain 72 - 8.5 con 72] + 6.348 (162.69) cos 72 - 162,69 Fr + 21.2 cos 59.6059 \ 102 am 72 + 19.54 cos 72 212 sun 59. 6059 [102 con $F_{I} = 3.568$ EFx = 0; 0= -2(18.77) cas 66.164 - 3.568 pm 72 +21.2 con 59.6059 + Fx Fx= 7,838 EFz=0. 0 = -2(18.77) am 66.164 - 6.348 + 3.568 cm72 + 21.2 am 59.605 Fz= 21.30 21, 2 am 59.606 = 18.29 21,2 con 59.606 = 10.73 18.77 am 66.164 17.17

18.77 02 66. 164 = 7.59

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	17 A	104.2	- ZZ. 3	7.6	-11.6	6.6	8.7	OQE
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A 74	В	-112.	103.	7.6	-64	-5,z	8.9	
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	18 A	64.	-263.	2.4	-17.1			
N.	ß	30.	-20.	- •				
. .	K A	108,6	- 41.4	14.6	-5.3	- ,	248.9)
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CONTROL STATES STATES DESCRIPTION STATES STATES STATES STATES STATES STATES STATES

$$I_1 = 16.75$$
 $I_2 = 55.375$ $8\frac{1}{2} \times 4 \times \frac{1}{4}$ $I_3 = 8.375$ $I_4 = 13.03$

$$\frac{18B}{8.375} \sigma = \frac{112}{8.375} + \frac{103}{13.03} + \frac{5.2}{6} = 13.37 + 7.90 + .9 = 22.19$$

$$T = \frac{3.8}{8.375} + \frac{295}{13.03} + \frac{1}{2} = .45 + 22.6 = 23.1$$

$$T_{T} = \frac{249}{2(3.75)(8.25)(.25)} = 16.1 \text{ KSI}$$

Systems Model = 40KSI

		<i>I</i> ,	₹,	Iz	22
* 4× 8 2× 4	6.0	16.75	8.315	53.4	13.43
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$$\frac{18B}{8.375} = \frac{112}{8.375} + \frac{103}{13.03} + \frac{5.2}{6} = 13.37 + 7.90 + .9 = 32.19 - 30.0$$

$$\frac{17B}{8.375} = \frac{3.8}{13.03} + \frac{295}{13.03} + \frac{1}{13.03} = .45 + 22.6 = 23.7 + 42.$$

16/19

$$T_{\gamma} = \frac{249}{2(3.75)(8.25)(.25)} = 16.1 \text{KSI}$$

Systems Model = 40KSI

X2 = 80KSI

Gimbal Columns CBor 11/12 V=-1., 4. 0.

EL, Grid	<u>M,</u>	M2	<u> </u>	Ve			
11 A	- 90.5	14.6	- 2.6	. 7	- Z. 4	-43.	
В	19.2	-15.1					
/2 A	-90.5	14.6	- Z, 6	-7	2.4	- 43	
A	19.3	15.1					
ll A	-203.	160.	-5.4	6.6	5.1	-110,	Ø QE
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12 A	- 461.	/3/.	-//.	5.2	-10.	29.1	
В	10.6	-93.					
1 A	907.	222.	15.z	4.9	16.4	70.8	72 PE
В	25 8 .	108.		-			
12 A	744.	-/3/.	11.7	-/,2	11.6	21.6	
3	242.	-78.					

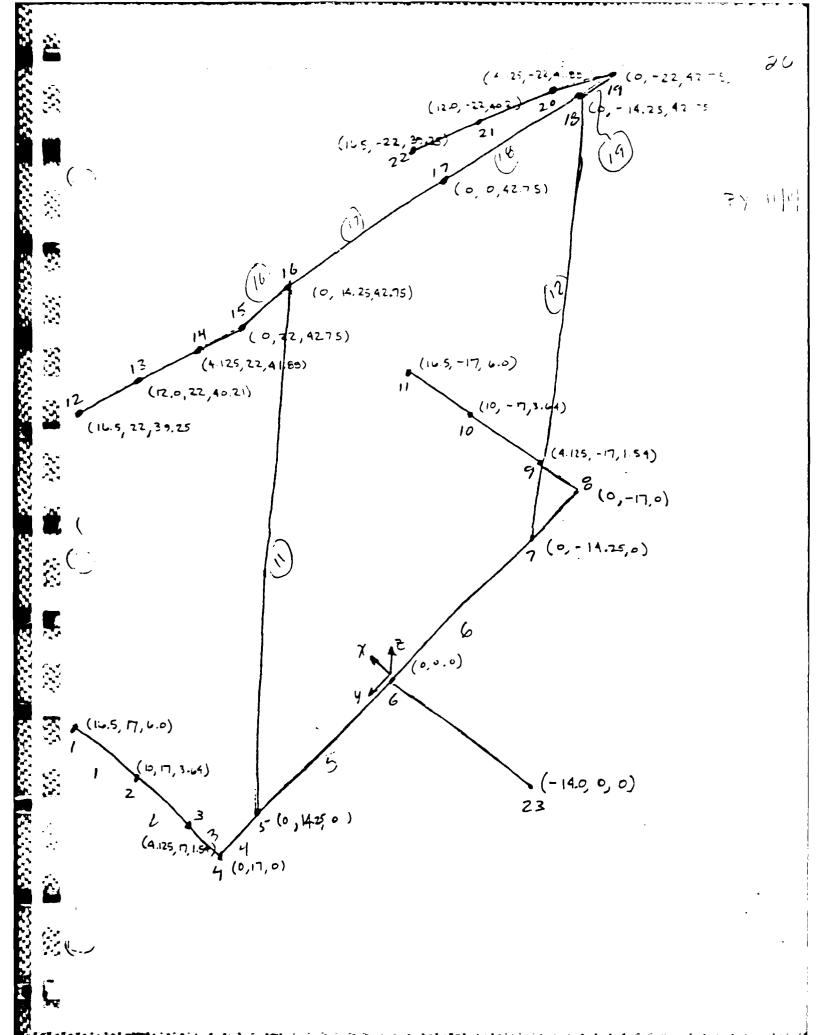
Top of Columns I,= 19.32 Z;= 7.73; I2=22.45 == 8.16
A= 5

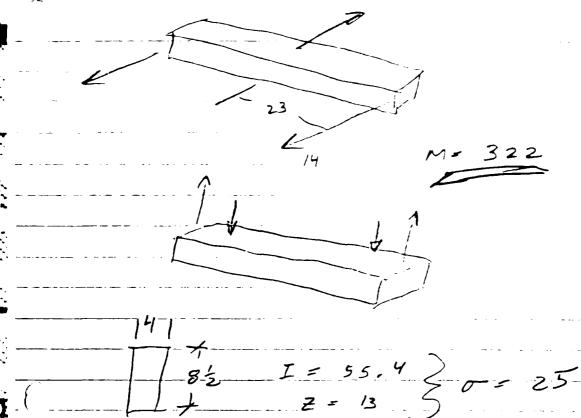
$$\sigma = \frac{258}{7.73} + \frac{123}{8.16} = 33.4 + 15 = 48$$

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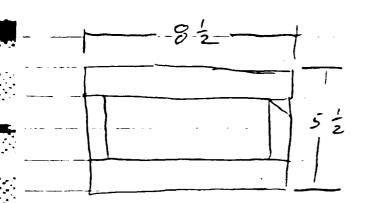
$$\overline{0} = \frac{258}{16.0} + \frac{123}{12.6} = 16.1 + 9.8 = 25.9$$

Systems was ZOKSI -230





Gim Bol Bottom Bean

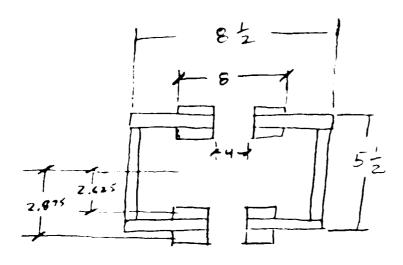


<u> </u>	8.5 (5.5) - 8 (4.75	رخ ()
	12	

$$\overline{I} = 5.5(8.5)^3 - 4.75(8)^3$$

$$I = 78.81$$

$$Z = 18.54$$





$$I = \frac{(8.5-4)(5.5)^3 - (8-4)(4.75)^3}{12} + B(4)(.25)^3$$

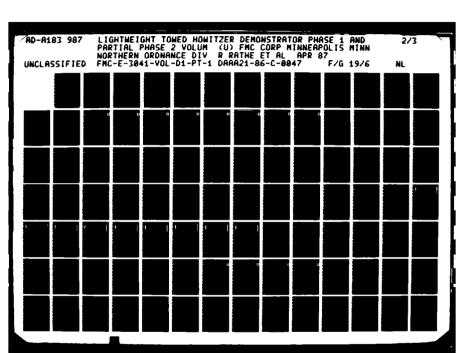
$$+ .25(8-4)(2)(2.625)^2 + .25(8-4)(2)(2.875)^2$$

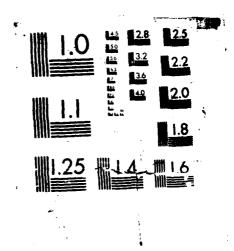
$$I = 57.02$$
 $Z = 19.01$

$$I_{2} = \frac{5.5(8.5)^{3} - 4.75(8)^{3} - .75(4)^{3}}{12} + \frac{4(.25)(8)^{3} - 4(.25)(4)^{3}}{12}$$

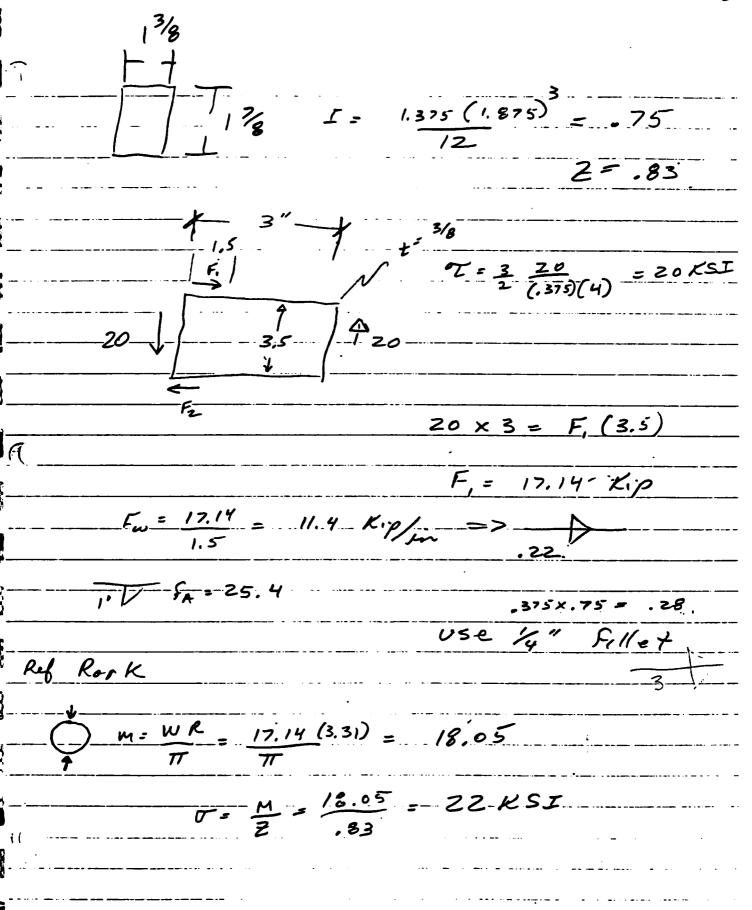
$$I_2 = 112.14$$
 $Z_2 = 26.39$

A = 11.5938 1,5625 $I = .5(6)^{3} + 4(1.5625)(t)(3-t/2)^{2} + 1.5625(t)^{3}$ I = 9 + 39.06 + .13 = 48 ; Z = 16.06 $t = 1^{3/8}$ I = 9 + 45,9 + ,34 = 55,29; Z- $\frac{I_{2} = 12(.25)^{3} + 4(1.375)(1.5625)^{3}}{12} + 6(.25)(2)(4)$ Iz= 141.85 , Zz= 12.15



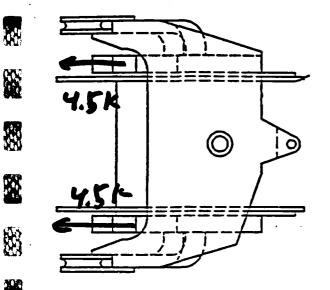


MICROCOPY RESOLUTION TEST CHART

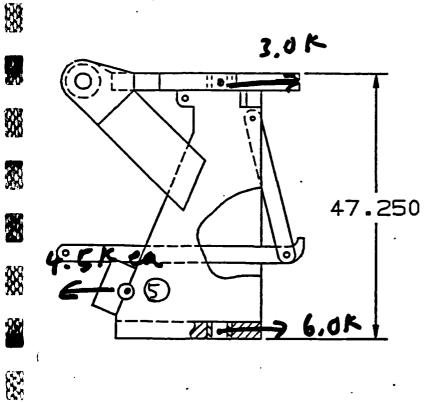


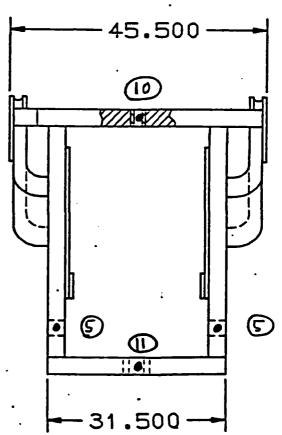
GIMBAL . ASS'Y

18,000 # 10-17-86 Towing CNDITION#



XX



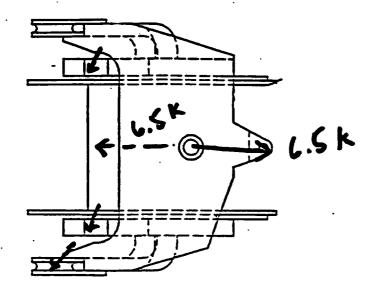


SCALE: 1/16

GIMBAL . ASS'Y

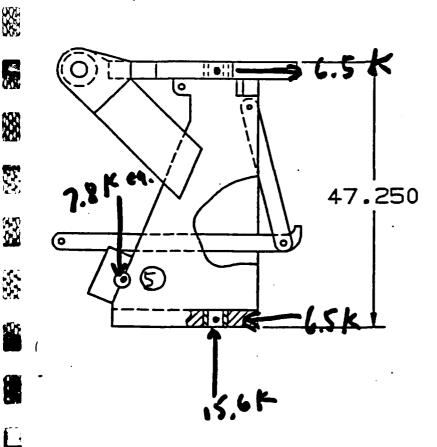
LOAD CONDITION#

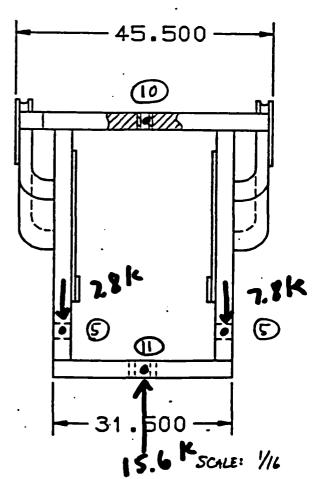
Aircraft 4.56 DM4



N.

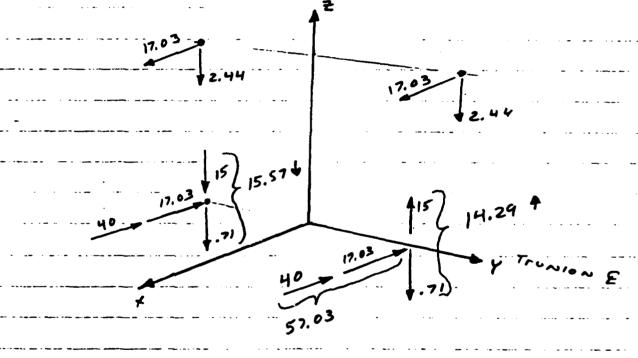
X





····•.	GIM BAL	LOADS	: UNITS; Kips	, <u>w</u>
		•		
. (Rislang Torqu	re 42,500	st 16 = 5	10 m Kip
4	Static Load	s Per So	-0 9-20-	86
	Assume Reco	_		
1.	Q Dea QE	Does wt	. 2	
		(2)	T	
	17.03	2.44		O
		· · · · · · · · · · · · · · · · · · ·	17.03	2.44
		· 🏊		V
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•		3		· · · · ·
	17.0			
	· · · • · · · · · · · · · · · · · · · ·		7.03	Thunion &
				71
	X	· · -		
S	same loads A	aplied to	THE Platfo	rom Frome
G	0 00g ; 22	. 2 Deg Tr	ever Se	
			<u></u>	
7	rovel loods	per Con	figuration	PLotform Sro
ئو _	Dave Bo A	lso Appl	ed to THE	. PLotform Sra
		-	· · - · · · · · · · · · · · · · · · · ·	
_				

2. O Deg QE, Deal ut + Recoil + Torque



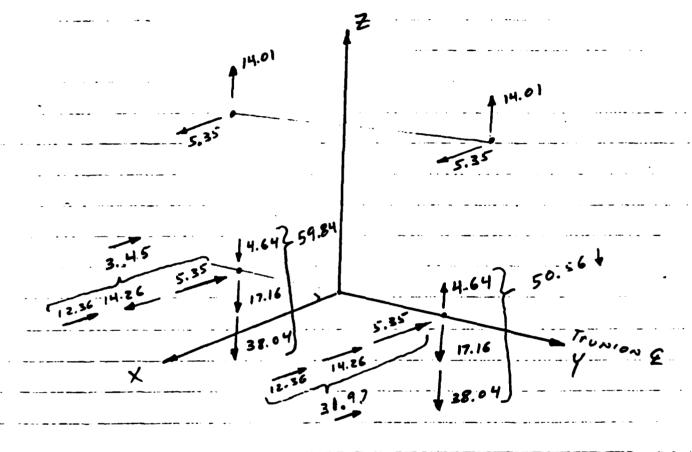
34" = 15. Kip

盟

3. 72 Dag QE, Deal wt + Recoil + Torque

20

V



$$\frac{(80 \text{ ain } 72)/2}{(80 \text{ con } 72)/2} = 12.36$$

$$\frac{(510 \text{ ain } 72)/34}{(510 \text{ con } 72)/34} = 14.26$$

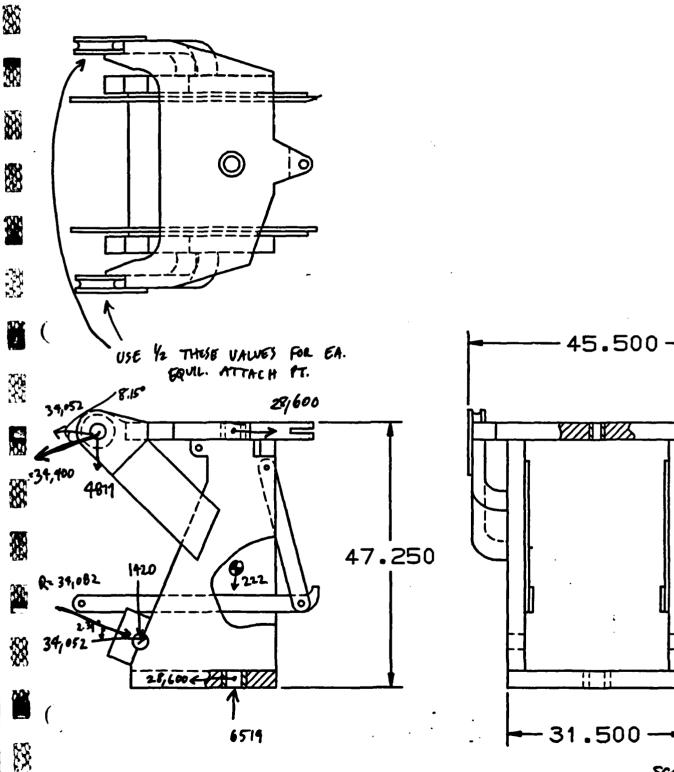
* (LOAD COND #5
	Loading on gimbal
O° QE	
	5 FA
2× 1702	- C - EXCIL,
	17.2 K
X	
	44"
	1420 US.
(13 ₂ 0	55.77 TRUM.
	7 TRUN.
2 1 3 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1	9500 X2 =79K 16" 77" FB
	6297 LBS.
72 QE	A BOVE:
	15.K- DINAMIC
	14,000 (\$5/14 = 0 = F8.44"
₩——	354 EQUIL
	- 34,52.3 - 4876 16
<u> </u>	- 79k · 37
۸ _٠ ,	FR = 95,034 LBS
<u> </u>	36-K
 	36K
T81776 T (T22770) 71125	+ 113,052 . 7 - 1420 . 16
- 39500	-4876.16 - 34,052.41
50,625	FA = 16,034
%	
ra,	

监

GIMBAL ASS'Y

LOAD CONDITION#1

9/21/86
0°05 + TRAV.

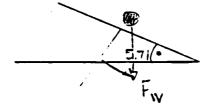


SCALE: 1/6

Forces the traverse cylinder sees

From geometry, 22.5° traverse => stroke = 11 in.

Force to traverse larrel up 10% orade



XX XX

37.

T=R Fw sin 5.71 T= 108 in-kip

Regimbel become to (C.q.)= 161.7

1) hold (static)

Sum moniones - gimbal prot

= 175.2 in.

Fw= 6077 15.

2) accel. assume moving 2 dea 3ec

$$\dot{9} = .014$$

$$T = \frac{6077}{386} (178.2)^{2} .014$$

$$= 7.0 \text{ kip}$$

10+al = 7.7 +7.0 = 14.7 kip

P.y. 11/6

Force to resist rifling torque \$ 10% grade

rifling torque: 509 in-kip sin 72 = 48 f in-kip

$$\frac{484}{14} = 34.6$$

XX

rifling 34.6 cos10 = 34.1 kip

static 7.7 kip

total = fill kis

PART NUMBER: 12585788, Inner Breech Band

DESCRIPTION: INNER BREECH BAND

The breech band design consists of an inner breech band and an outer beech band. The two-piece design was developed to simplify disassembly of the tube and breech when the tube needs replacing after extended use or if other maintenance activities require disassembly.

STATUS:

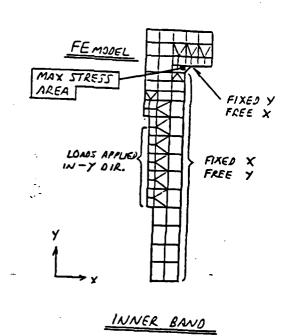
A drawing of the inner breech band (TDP, Dwg. 12585788) was released and given to Benet for machining. The FEA model that was created to support the design can be found on the following pages of this section. With a load of 79,000 lb acting on the inner band, the factor of safety is 5.2 using 4340 steel for the band material. Two drawings of keys that interface with the inner breech band, breech key (TDP, Dwg. 12585966) and ring key (TDP, Dwg. 12585965) were also provided to Benet for machining.

AUTHORS: Joe Turek, Joe Fishbein

INNER BREECH BAND

The inner breech band was analyzed with a FEM of a cross-section. The inner radius of the flange is fixed vertically, and the outer part of the tube is free to translate vertically. Loads are applied where the threads engage the outer breech band.

The band is loaded by recoil of the gun at firing. Maximum load is 79,000 lb. The maximum resulting stress is 23,000 PSI, occurring at the corner between the tube and flange parts. For 4340 steel, with a yield strength of 120,000 PSI, the factor of safety (FS) is 5.2.



BREECH BANDS

1. RECOIL THRUST - . . 79,000 LB. ____

NOTE: WHEN CHECKING STRESSES IN CYLINDER __SOCKET___.

OF OUTER BAND, IT WAS ASSUMED THAT _ONE CYLINDER

HAD FAILED, AND THRUST WAS CARNED BY _____

REMAINING THREE.

2. TRANSPORT - BUMP + SKID

FORCE	NODE 1	NODE 2
FX	-3700 <i>1</i> 6	-3500 16
FY	8600 B	-16400 16
FZ .	3100 16	-7600 16
MX	. 0	O
MY	-9200 in-16	-1400 pr.16
MZ	4900 m.lb	26,200 /2-16

3. TRANSPORT - 4.5G AIR DROP

FORCE	NODE 1	NO16 2
Fx	-600 LB.	600 LB.
FY	-9800 U.	-7700 LB.
F L	100 LB.	-100 LB.
MX	٥	0
MY	-22820 in-ls.	.20900 m16
MZ	-27200 m.1b.	23800 In-16

Subject

LTHD

Analyst GM7
Project Number



INNER BREACH BAND

LOADING: LOADING UNCERTAIN AT THIS TIME, SO APPLY
100,000 LB. AND SCALE RESULTS WHEN
ACTUAL LOADING IS KNOWN.

CIRCUMFORGNCE: TT (14.325 m): 45.00 in

P = 100,000 /b = 2222.06 lb/in 45.00 in

FOR O.1 in THICK "SLICE", TOTAL LOAD = 222.2 16

DIVISE AMONG 10 NOOAL POINTS: 22.22 16/PUINT

MAX. TONSILE STRESS IN MODEL . 29/10 PSI IN CLEMENT 65

MAXIMUM RECOIL LOAD = 79,000 16 (PER 5. DACKO, 1/19/87)

MAX STRESS IN BAND = 23,000 PSI

FOR 120 KSI MATIL, FS = 5.2 ACOINST YIEUNG

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ل APPLIED ECHANICS

	M	ECHANICS
Subject	Analysi A 777	True!
1740	Project Number	
	EC. No. Date /-/5.Y	

ININEL BROECH BAND

LOADING UNCERTAIN AT THIS TIME, SO APPLY
100,000 LB. AND SCALE RESULTS WHEN
ACTUAL LOADING IS KNOWN.

CIRCULIFORENCE: # (14325 in): 45.00 in

P = 100,000 16 = 2222.06 16/in

FUR O.I. THICK "SLICE", TOTAL LOAD = 222.2 B

DIVIDE AMONG 10 MORL POINTS: 22.22 15/PUINT

MAX. TENSILE STRESS IN MODEL . 29/10 ps; IN ELEMENT 65

MAXIMUM RECOIL LOAD = 79,000 16 (PER 5. DACKO, 1/19/87)

MAX STRESS IN BAND = 23,000 PSI

FUR 120 KSI MATIL, FS = 5.2 ACOINST YIELDING

Rorthern Ordnance Division Minneapolis

APPLIED MECHANICS

Subject	Analyst	017
LTHD	Project Number	
	EC. No.	1-15.87

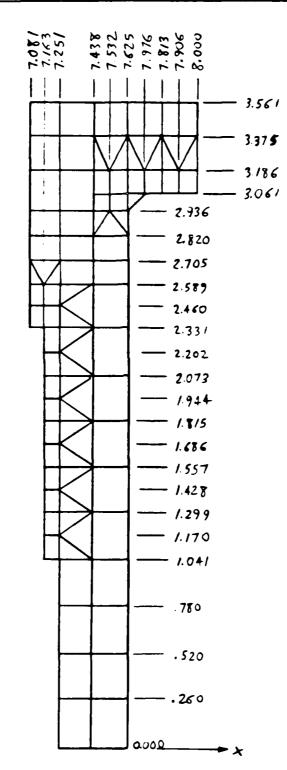


INNER BREECH

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Sheet ____01___

8

%

LTHD

Analyst

GMF

Project Number

EC. No.

Date
1-15-87



Z

INNER BREACH

7.08/	7.25/	7.438	7.625 7.976 7.906 8.000
		11	3.56
54	60	84	85 86
\$3	59	X/	19 10 3.37 5
5	150	10//	7/12/13/14 3.06/
\$1	57	964	— z. 9 36
SU	56	62	2.820 2.705
48/49	36	61	2.589
43 41	24	42	2.460
18	222	41	- 2.33/ - 2.202
16	34 28	40	2.073 1.944
14	27	39	1.815
12 11	21/22/20	38	1.557 1.428
8	A TO	37	— 1.299 — 1.170
[9]	7	8	1.041
	5	6	.780
	3	4	520
	/	2	260

Northern Ordnance Division Minneapolis

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APPLIED MECHANICS

LTHD

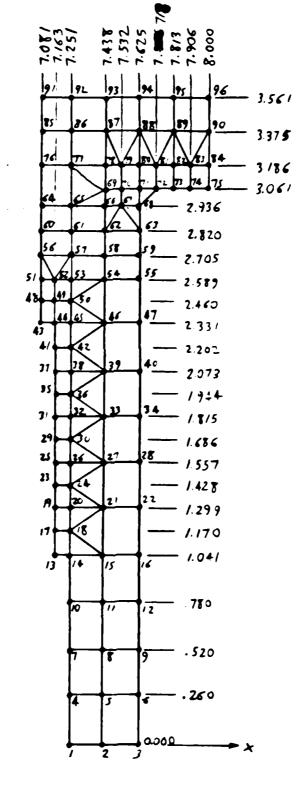
Analysi QNF

Project Number

BC: No. | Dyso 7-15-87



INNER BREACH



Northern Ordnance Division Minneapolis

APPLIED MECHANICS

LTHD

Analyst

CAN

Project Number

EC. No.

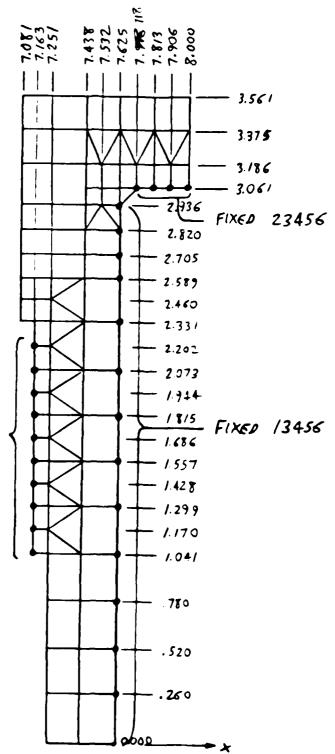
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1-15-87



INNER BREACH BAND

F

FORCES: 10 @-22.22 16
2 DIRECTION



	化 North	nern Ordnance Division eapolis	Anet	APPLIED MECHANICS
100 K		LTHI	Proje	vet 3:17 vet Number No. Date
88	INNER	BREACH BAND	- PRINCIPAL STRE	<i>रऽऽह</i> ऽ
8 3				
338 838 338 838	ar -/543 470	-/772 +	-745 327	-148
333		29//	-1876	
** ** **	1927 × -/822 -2344	+ / / / / / / / / / / / / / / / / / / /	730 777 X 2961 2234	7-50 -2177
	4444 -1256	5935 279 -R20	-10920 -8/55 \$331	792 -93 168
	2567		24530 Ann	
	5/97	4381 6883 5549		
á,	577 4229 12250 A	12/90	8868 -	
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	recentación de la compansión de la compa	/12.950 Dichardianakan (14.000)	የአርት የውጭ የተመረቀ የተመረቀ	ſijĸĠĸĬĠĸĬĠĸĬĠĸ ĠĸĠĸĊĸĊĸĊĸĊĸĠĸĠĸĊĸŎĸĠŎĸŎŎŎŶŶŎŶŎŎ

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RENUMBER NODES

Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

Node Renumbering Cross Reference List

Was	Ìs	Was	Is	Was	Ĭs
1	1	2	2	3	5
4	4	5	3	6	6
7	8	8	7	9	9
10	11	11	10	12	12
13	19	14	14	15	13
16	15	17	20	18	16
19	22	20	21	21	17
22	18	23	26	24	23
25	28	26	27	27	24
28	25	29	32	20	29
31	34	32	33	33	30
34	31	35	38	36	35
37	40	38	39	3 9	36
40	37	41	44	42	41
43	51	44	46	45	45
46	42	47	43	48	52
49	50	50	47	51	58
52	54	53	53	54	48
55	49	56	59	57	56
58	55	59	57	60	63
61	61	62	60	63	62
64	67	65	65	66	64
67	66	68	68	69	70
70	69	71	73	72	74
73	82	74	90	75	95
76	72	77	71	78	76
79	75	80	77	81	81
82	83	83	91	84	96
85	79	86	78	87	80
88	84	89	89	90	93
91	86	9 2	85	93	87
94	88	95	92	96	94

Original Nodal Band 14 Final Nodal band 10 ASSEMBLE STIFFNESS MATRIX Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

STIFFNESS ASSEMBLY SUMMARY

Number of	Node Points	96
Number of	Truss and Beam Elements	O
Number of	Plate Elements	88
Number of	Spring Elements	O
Number of	Nodes with Restraints	15
Number of	Blocks in the Matrix	2

BLOCK NUMBER 1

FORM Matrix
PACK Matrix
Size = 10240 Bytes
TRIANGULARIZE Matrix

BLOCK NUMBER 2

FORM Matrix
PACK Matrix
Size = 6856 Bytes
TRIANGULARIZE Matrix

ASSEMBLE STIFFNESS MATRIX Version 1.1 02/01/85 LTHD inner breach band under 100,000 lb. recoil

CROSS REFERENCE LIST

Is Node Verus Internal Equation Number

Is Node	TR Eqn.	ANSLAT	ION Eqn.	/	Eqn.	ROTATI Eqn.	ON Eqn.
				/			
1	1_	2					
2 3	3	4					
3	5	6					
4	7	8					
5		9					
6		10					
7	11	12					
8	13	14					
9		15					
10	16	17					
11	18	19					
12		20					
13	21	22					
14	23	24					
15	5.	25					
16	26	27					
17 18	28	29 70					
19	7.	30 30					
20	31 77	32 34					
21	33 35	34 36					
22	35 37	28 28					
23	37 39	38 40					
24	41	42				•	
25	41	42 43					
26	44	45 45					
27	46	47					
28	48	49					
29	50	51					
30	5 2	53					
31	02	54					
32	55	56					
33	5 7	58					
34	57 59	60					
35	61	62					
36	6 3	64					
37		65					
38	66	67					
39	68	69					

ASSEMBLE STIFFNESS MATRIX Version 1.1 02/01/85 LTHD inner breach band under 100,000 lb. recoil

Is	TR	ANSLAT	ION	/		ROTATI	ON
Node	Eqn.	Eqn.	Egn.	1	Eqn.	Eqn.	Egn.
				1			
40	70	71					
41	72	73					
42	74	75					
43		76					
44	77	78					
45	79	80					
46	81	82					
47	83	84					
48	85	86					
49		87					
50	88	89					
51	90	91					
52	92	93					
53	94	95					
54	96	97					
55	98	99					
56	100	101					
57		102					
58	103	104					
59	105	106					
60	107	108					
61	109	110					
62		111					
63	112	113					
64	114	115					
6 5	116	117					
66	118	119					
67	120	121					
68		122					
69 70	123	124					
70	125	126					
71 72	127	128					
73	129 131	130 132					
74	133	102					
75	134	135					
76	134	135					
77	138	137					
78	140	141					
79	142	143					
, ,	172	* T					

ASSEMBLE STIFFNESS MATRIX Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

15	IR	ANSLAT	TUM	/		ROTATI	ŪΝ
Node	Eqn.	Eqn.	Eqn.	1	Eqn.	Eqn.	Eqn.
				1			
80	144	145					
81	146	147					
82	148	149					
83	150	151					
84	152	153					
85	154	155					
86	156	157					
87	158	159					
88	160	161					
89	162	163					
90	164	165					
91	166	167					
92	168	169					
93	170	171					
94	172	173					
95	174	175					
96	176	177					

SOLVE DISFLACEMENTS

Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

LOAD CASE 1

CONCENTRATED LOADS

Node	Fx	Fy	Fz	M×	My	Mz
13	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
17	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
19	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
23	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
25	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
29	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
31	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
35	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
37	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
41	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00

SOLVE DISFLACEMENTS

Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

LOAD CASE 1

APPLIED LOAD VECTOR

Node	F×	Fy	Fz	M×	My	Mz
13	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
17	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
19	.0000E+00	222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
23	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
25	.0000E+00	222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
29	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
31	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
35	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
37	.0000E+00	222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
41	.0000E+00	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00

SOLVE DISPLACEMENTS

Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

LOAD CASE 1

DISPLACEMENTS

	Tra	nslati	on s	1	F: D	tatio	n s
Node	X	Υ	Z	/	X	Y	Z
				/			
1	8766E-07		.0000E+00		.0000E+00	.0000E+00	.0000E+00
2	6644E-07		.0000E+00		.0000E+00	.0000E+00	.0000E+00
3		6927E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
4	2354E-06		.0000E+00		.0000E+00	.0000E+00	.0000E+00
5		6928E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
6		6929E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
7		6919E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
8	1914E-06		.0000E+00		.0000E+00	.0000E+00	.0000E+00
9		6938E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
10		6903E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
11		6938E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
12		6920E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
13		7328E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
14		7006E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
15		6881E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
16		6865E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
17		7173E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
18		7018E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
19		7104E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
20		6983E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
21		6818E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
22		6756E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
23		7029E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
24		6916E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
25		6938E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
26		6826E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
27		6671E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
28		6616E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
29		6825E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
30		6717E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
31		6692E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
32		6586E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
33		6439E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
34		6388E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
35		6538E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
36		6436E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
37		6361E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
38		6263E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
39		6115E-03	.0000E+00		.0000E+00	.0000E+00	.0000E+00
40	.0000E+00	6 073E-03	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

SOLVE DISFLACEMENTS

Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

LDAD CASE 1

	Translati	ons /	R o	tatio	n s
Node	X Y	Z /		Y	Z
		/			
41	.2629E-046165E-03	.0000E+00 /		.0000E+00	.0000E+00
42	.2285E-046078E-03	.0000E+00 /		.0000E+00	.0000E+00
43	.3450E-045785E-03	.0000E+00 /		.0000E+00	.0000E+00
44	.3387E-045888E-03	.0000E+00 /		.0000E+00	.0000E+00
45	.2930E-045905E-03	.0000E+00 /		.0000E+00	. 0 0000E+00
46	.1856E-045691E-03	.0000E+00 /		.0000E+00	.0000E+00
47	.0000E+005619E-03	.0000E+00 /		.0000E+00	.0000E+00
48	.4372E-045844E-03	.0000E+00 /		.0000E+00	.0000E+00
49	.4339E-045820E-03	.0000E+00 /		.0000E+00	.0000E+00
50	.4010E-045743E-03	.0000E+00 /		.0000E+00	.0000E+00
51	.3722E-045981E-03	.0000E+00 /		.0000E+00	.0000E+00
5 2	.4042E-045829E-03	.0000E+00 /		.0000E+00	.0000E+00
53	.3911E-045607E-03	.0000E+00 /		.0000E+00	.0000E+00
54	.2725E-045154E-03	.0000E+00 /		.0000E+00	.0000E+00
5 5	.0000E+004B46E-03	.0000E+00 /		.0000E+00	.0000E+00
56	.2227E-046149E-03	.0000E+00 /		.0000E+00	.0000E+00
57	.2671E-045620E-03	.0000E+00 /		.0000E+00	.0000E+00
58	.2453E-044838E-03	.0000E+00 /		.0000E+00	.0000E+00
59	.0000E+004350E-03	.0000E+00 /		.0000E+00	.0000E+00
60	1493E-046436E-03	.0000E+00 /		.0000E+00	.0000E+00
61	3600E-055636E-03	.0000E+00 /		.0000E+00	.0000E+00
62	.3122E-054597E-03	.0000E+00 /		.0000E+00	.0000E+00
63	.0000E+003669E-03	.0000E+00 /		.0000E+00	.0000E+00
64	7481E-046764E-03	.0000E+00 /		.0000E+00	.0000E+00
65	6167E-045711E-03	.0000E+00 /		.0000E+00	.0000E+00
66	4672E-044390E-03	.00000E+00 /		.0000E+00	.0000E+00 .0000E+00
67 68	2473E-043678E-03 .0000E+002914E-03	.0000E+00 / .0000E+00 /		.0000E+00	.0000E+00
69	.0000E+002914E-031558E-034288E-03	.0000E+00 /		.0000E+00	.0000E+00
70	1542E-033413E-03	.0000E+00 /		.0000E+00	.0000E+00
71	1671E-032196E-03	.0000E+00 /		.0000E+00	.0000E+00
72	1700E-03 .0000E+00	.0000E+00 /		.0000E+00	.0000E+00
73	1688E-03 .4364E-04	.0000E+00 /		.0000E+00	.0000E+00
74	1680E-03 .1466E+03	.0000E+00 /		.0000E+00	. 00000E+00
75	1673E-03 .2443E-03	.0000E+00 /		.0000E+00	. 00000 E+ 00
76	2863E-037362E-03	.0000E+00 /		.0000E+00	.0000E+00
77	2821E-035773E-03	.0000E+00 /		.0000E+00	.0000E+00
78	2898E-034140E-03	.0000E+00 /		.0000E+00	.0000 E+ 00
79	2997E-033076E-03	.0000E+00 /		.0000E+00	, 0000 E+ 00
80	3067E-031849E-03	.0000E+00 /		.0000E+00	.0000E+00
81	3054E-036626E-04	.0000E+00 /		.0000E+00	. 00000 E +00

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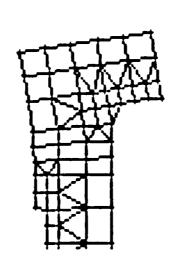
SOLVE DISPLACEMENTS Version 1.1 02/01/85

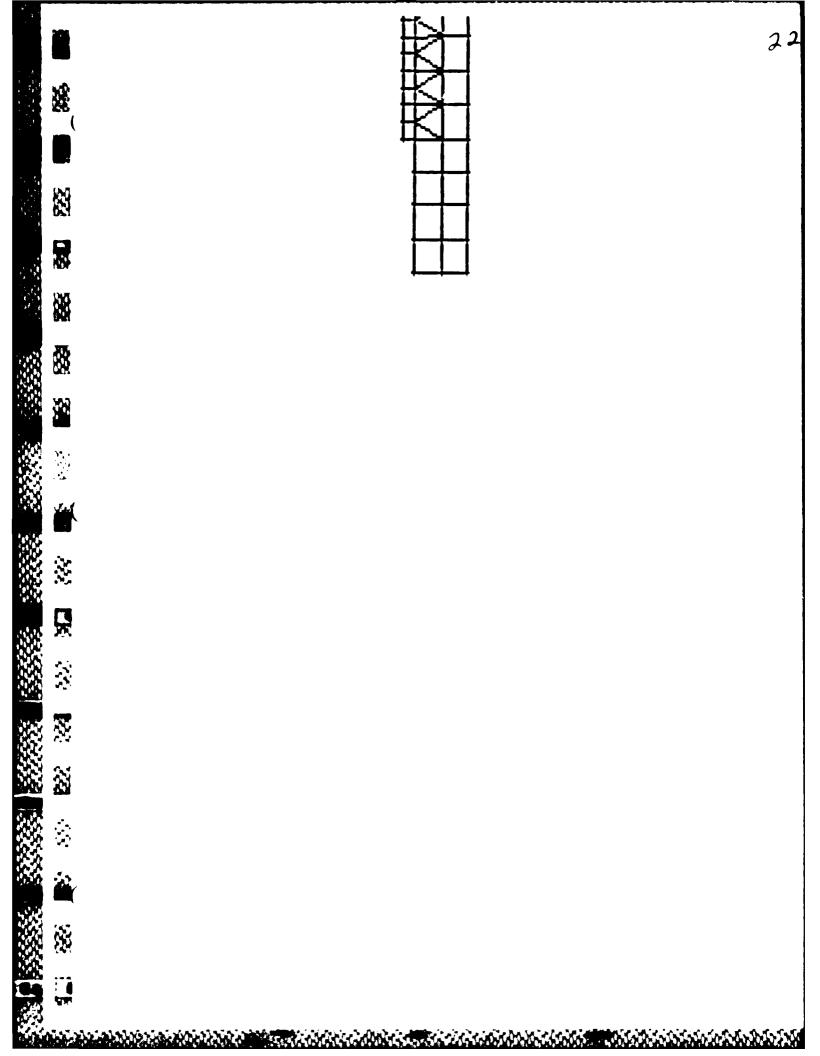
LTHD inner breach band under 100,000 lb. recoil

LDAD CASE 1

	Tra	nslati	0 N S	/	₽ o	tatio	N 5
Node	X	Y	Z	/	X	Y	Z
				/			
82	2987E-03	.4954E-04	.0000E+00	/	.0000E+00	.ĢQQQE+QQ	.0000E+00
83	2983E-03	.1449E-03	.0000E+00	/	.0000E+00	.00000E+00	.00000E+00
84	2988E-03	.2462E-03	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
85	4868E-03	7545E-03	.00000E+00	/	.0000E+00	.0000E+00	.0000E+00
Bé	4870E-03	5814E-03	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
87	4948E-03	3933E-03	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
88	5075E-03	1822E-03	.0000E+00	/	.0000E+00	.0000E+00	.00000E+00
89	5061E-03	.3853E-04	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
90	5053E-03	.2466E-03	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
91	68 45 E-03	7582E-03	.0000E+00	/	.0000E+00	.0000E+00	.00000E+00
92	6869E-03	5811E-03	.00000E+00	/	.0000E+00	.0000E+00	.0000E+00
93	6973E-03	3851E-03	.0000E+00	/	.0000E+00	.0000E+00	.00000 E+ 00
94	7081E-03	1790E-03	.0000E+00	/	.0000E+00	.00000E+00	.0000E+00
9 5	7148E-03	.3509E-04	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
96	7149E-03	.2487E-03	.0000E+00	1	.0000E+00	.0000E+00	.0000E+00

ML> AX





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SOLVE FLATE LOADS/STRESSES | Version 1.1 | 02/01/85

LTHD inner breach band under 100,000 lb. recoil

Load Case 1:

FLATE LOADS AND/OR STRESSES

Loads	Node	F::	Fy	Fz	M;	My	Mz
Stress Stress	Surf	Sigma X Shear XZ	Sigma Y Shear YZ	Tau XY	Sigma 1	Sigma 2	Ang le
			OUAD	FLATE NO.	1		
Loads	1	1667E-1	3 .1790E-11	. 00000 E+ 00	.0000E+00	.0000E+00	. 00000E+00
Loads	2	.1507E+0	o −.1216E+00	.00000 E+ 00	.0000E+00	.0000E+00	.0000E+00
Loads	5	.7166E-0	28783E-01	.0000E+00	.0000E+00	.0000E+00	.00000E+00
Loads	4	1578E+0	o .20 95E+ 00	.00000E+00	.0000E+00	.0000E+00	.0000E+0
Stress	MEM	.6070E+0	1 .6505E+01	8057E+01	.1435E+02	1772E+01	- 4 5.8
			OUAD	FLATE NO.	2		
Loads	2	1507E+0	0 .1216E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	3	.0507E+0	07085E-11	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	6	.1427E+0	01390E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	5	3427E+0	0 .1740E-01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	.1898E+0	º6505E+01	5348E+01	.2005E+02	7582E+01	-11.4
			OUAD	PLATE NO.	3		
Loads	4	.1578E+0	02095E+00	.0000E+00	.0000E+00	.0000E+00	. 0000E+00
Loads	5	.2695E+0	0 5775E+ 00	.00000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	8	3304E+0	01659E-01	.00000 E +00	.0000E+00	.0000E+00	.0000E+00
Loads	7	9687E-0	1 .8036E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	2344E+0	1 .4208E+02	2285E+02	.5174E+02	1200E+02	-67.1
			***DUAD	FLATE NO.	4 * * *		
Loads	5	.6611E-0	1 .6479E+00	.0000E+00	.0000 E+ 00	.0000E+00	. 00000 E+ 00
Loads	6	.5420E+0	0 .13 90E+0 0	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	9	7425E-0	19845E+00	. 0000E+00	. OOOOE+OO	. 000 0E+ 00	. OOOOOE+OO
Loads	8	5339E+0	0 .1976E+00	.0000E+00	.0000E+00	.0000E+00	.OOQOE+QQ
Stress	MEM	.1799E+0	D4208E+02	3252E+02	.3222E+02	5632E+02	-23.6
			CUAD	FLATE NO.	5		
Loads	7	.9687E-0	1B0%6E+00	, 0000E+00	. 00000 E + 00	.0000E+00	, ¢¢¢¢¢E+¢¢
Loads	8	1820E+0	0 .2442E+00	.0000E+00	. 00000E+00	.0000E+00	. OOOOOE+OO
Loads	1 1	. 1006E+0	01259E+00	.0000E+00	. ΦΦΦΦΕ+ΦΦ	, ÓÒÒÒŒ +ÒÒ	.ÖÖQOE+Ö°
Loads	10	1546E-0	1 .6852E+00	.0000 E+ 00	,QOQQE+QQ	, 00000E+00	.ÕÕ⇔ÕE+Õď
Stress	MEM	D131E+0	1 .2991E+02	.4551E+01	.3053E+02	3746E+⊕1	60.3
			###DUAD	FLATE NO.	6***		
Loads	8	.1046E+0	14252E+00	.0000E+00	.0000E+00	. 0000E+00	O``````````````````````````````````
Loads	9	2766E+0	1 .9845E+00	,0000E+00	.0000E+00	.0000E+00	.ġ∍ŏġ E +od
Loads	12	3222E+0	1 .1407E+01	. 00000E+00	.0000 E +00	.0000E+66	. OOOOE+O
l.oads	1 1	.4941E+0	11966E+01	. 0000E+00	. 00000 E+ 00	. 00000E+00	<u>, форфЕ+(н</u>
Stress	MEM	2303E+0	32991E+02	.9197E+02	.589BE+01	2661E+07	68.7
			OUAD	FLATE NO.	7		
Loads	10	.1546E-0	16852E+00	. OOOOE,+OO	, 0000 E+ 00	. OchcoE+Oc	. Occion E • n
		1058E+0	2 .8547E+01	. ŎĢŎŎ E + ŎŎ	.ŭċayE+oe	. (aòoòE+(aò	. OcočE+ci

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Version 1.1 00/01/85

LTHD inner breach band under 100,000 lb. recoil

Loads Stress Stress	Node Surf	Fx Sigma X Shear XZ	Fy Sigma Y Shear YZ	Fz Tau XY	Mx Sigma 1	My Sigma 2	Mr Angle
Loads	15	3806E+01	.6195E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	14	.1437E+02	1406E+02	.00000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	5511E+03	4204E+03	.5648E+03	.8285E+02	1054E+04	48.3
			DUAD F	LATE NO.	B		
Loads	11	.5536E+01	6455E+01	.0000E+00	.0000E+00	.0000E+00	.00000 E+ 00
Loads	12	9119E+01	1407E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	16	8346E+01	.6407E+01	.0000E+00	.00000 E+ 00	.0000E+00	.0000 0E+ 00
Loads	15	.1193E+02	.1454E+01	.0000E+00	.0000E+00	.0000E+00	.ÖÖÖÖE+∪∪
Stress	MEM	6692E+03	.4204E+03	.1916E+03	.4531E+03	7019E+03	80.3
			QUAD F	LATE NO.	9		
Loads	13	.8768E-12	2222E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	14	1848E+02	.1037E+02	.0000E+00	.0000E+00	.0000E+00	.00000E+00
Loads	18	.7486E+01	.1672E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	17	.1100E+02	4875E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	8525E+03	.1346E+04	.2100E+04	.2618E+04	2124E+04	58.8
			DUAD F	LATE NO. 1	10		
Loads	17	1100E+02	1735E+02	.00000E+00	.0000E+00	.0000E+00	. 00000E+00
Loads	18	+.4267E+01	.614BE+01	.0000E+00	.0000E+00	.0000E+00	.00000 E+ 00
Loads	20	.8773E+01	.1623E+02	.0000E+00	.0000E+00	.0000E+00	.00000 E+ 00
Loads	19	.6491E+01	5030E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	.3493E+03	.1272E+04	.1735E+04	.2606E+04	9841E+03	52.5
			DUAD F	LATE NO. 1	11		
Loads	19	6491E+01	1719E+02	.0000E+00	.00000E+00	.0000E+00	.0000E+00
Loads	20	7315E+01	.3324E+01	.0000E+00	.0000E+00	.0000E+00	. 0000E+00
Loads	24	.6574E+01	.1691E+02	.0000E+00	.0000E+00	.0000E+00	.QOQQE+QQ
Loads	23	.7232E+01	3049E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	5745E+02	.1576E+04	.1569E+04	.2528E+04	1010E+04	58.7
			CUAD F	LATE NO. 1	[2		
Loads	27	7232E+01	1917E+02	.0000E+00	.0000E+00	"QÓQÓE+QQ	.00000 E +00
Loads	24	6635E+01	.1213E+01	.0000E+00	.00000 E+ 00	.0000E+00	. 00000E+00
Loads	26	.6876E+01	.1911E+02	.0000E+00	.0000E+00	.0000E+00	.OOOOE+00
Loads	25	.6991E+01	1157E+01	.0000E+00	.0000E+00	.0000E+00	.φφούΕ+ύψ
Stress	MEM	.1866E+02	.2041E+04	.1576E+04	.2902E+04	8426E+03	61.3
			DUAD F	LATE NO. 1	13		
Loads	25	6991E+01	2106E+02	.0000E+00	.0000E+00	.0000E+00	. ÇOÇÇE+OĞ
Loads	26	6717E+01	8500E+00	.0000E+00	.0000E+00	.0000E+00	. OCOOL + OU
Loads	30	.6672E+01	.2094E+02	.0000E+00	.0000E+00	.0000E+00	. 0000E+00
Loads	29	.7035E+01	.9689E+00	.0000E+00	.0000E+00	.0000E+00	, OOOOE+OO
Stress	MEM	34T0E+01	.2490E+04	.1558E+04	.3239E+04	7519E+03	64.3
			DUAD F		4		
Loads	29	7035E+01	2319E+02	, 0000£+00	.0000E+00	.0000 E+ 00	. ΟξιάτίΕ + άπ

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Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

	Loads	Node	Fx	Fy	Fz	M ;;	My	Mz
	Stress	Surf	Sigma X	Sigma Y	Tau XY	Sigma 1	Sigma 2	Angle
	Stress		Shear XZ	Shear YZ				
	Loads	30	6747E+01	2952E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	35	.6750E+01	.2316E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	31	.7033E+01	.2985E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	.2088E+00	.2971E+04	.1566E+04	.3644E+04	6730E+03	66.7
				DUAD P	LATE NO. 1	5		
	Loads	31	7033E+01	2520E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	25	6662E+01	4969E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	36	.675BE+01	.2504E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	35	.6937E+01	.5129E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	.7382E+01	.3429E+04	.1556E+04	.4031E+04	5946E+03	68.9
				CUAD P		6		
•	Loads		6937E+01		.0000E+00	.0000E+00	.0000E+00	.0000E+00
_	Loads			7126E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	38	.6437E+01	.2723E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	37	.7278E+01		.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	2642E+02		.1559E+04	.4459E+04	5679E+03	70.8
				QUAD P		L7		
	Loads		7278E+01		.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	38	6916E+01		.0000E+00	.0000E+00	.0000E+00	.00000E+00
	Loads	47	.7678E+01		.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	4 1	.6416E+01		.0000E+00	.0000E+00	. 0000E+00	.0000E+00
	Stress	MEM	.6682E+02		.1602E+04	.4844E+04	4702E+03	71.5
		_		***DUAD P		8***		
	Loads	41		3102E+02	.0000E+00	.0000E+00	. 0000E+00	.0000E+00
	Loads	42		1405E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	45	.5609E+01		.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	44	.3623E+01		.0000E+00	.0000E+00	.0000 E +00	.0000E+00
	Stress	MEM	.2165E+03		.1049E+04	.5337E+04	.1586E+01	76 .4
				***TRIANGULA				
	Loads	14		.3684E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads		6680E+01	.1769E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	18	.2565E+01		.0000E+00	.0000E+00	.0000E+00	. 0000E+00
	Stress	MEM		5832E+03	.2743E+03		1165E+04	64.8
				***TRIANGULA				
	Loads			2107E+02	.0000E+00	.0000E+00	.0000E+00	.0000 E+ 00
	Loads	21	.3513E+00		.0000E+00	.0000E+00	.0000E+00	.000E+00
,	Loads	24	.9999E+01		.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	.5446E+02		.1069E+04		5101E+03	62.2
	1 4 -	~ .		***TRIANGULA			ALCONOMIC ACTOR	AND AND THE SECOND
	Loads			3007E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	27	.4584E+00	.6957E+01	.0000E+00	.0000E+00	.0000 E+ 00	. ტტტტ E+ 90

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LTHD inner breach band under 100,000 lb. recoil

	Loads	Node	F×	Fy	Fz	M×	My	Mz
	Stress	Surf	Sigma X	Sigma Y	Tau XY	Sigma 1	Sigma 2	Angle
	Stress		Shear XZ	Shear YZ				
	Loads	30	.1008E+0			.0000E+00		.0000E+00
	Stress	MEM	.7107E+0			.2885E+04	3423E+03	69.0
					LAR PLATE NO.	— -		
	Loads	32		23875E+0		.0000E+00		.0000E+00
	Loads	33	.3534E+0			.0000E+00		.0000E+00
	Loads	36	.1024E+0			.0000E+00		.0000E+00
	Stress	MEM	.5479E+0			.3716E+04	2727E+03	73.4
		70	44475.0		LAR FLATE NO.			00000
	Loads			24716E+0		.0000E+00		.0000E+00
	Loads		7902E+0			.0000E+00	•	.0000E+00
	Loads	42	.1246E+0			.0000E+00		.0000E+00
	Stress	rie ri	1225E+0			.4508E+04	5060E+03	73.9
٠.		A E	- 14405+0	24650E+0	LAR FLATE NO. 2 .0000E+00	. 24*** .0000E+00	.0000E+00	overes and
	Loads		4068E+0					.0000E+00
	Loads Loads	50	4066E+0			.0000E+00	· •	.0000E+00
	Stress		6308E+0			.4417E+04		.0000E+00 66.3
	or ess	FIET	00006+0		LAR PLATE NO.		1377E+04	00.0
	Loads	18	1945E+0	11057E+0		.0000E+00	.0000E+00	.0000E+00
	Loads			19044E+0		.0000E+00		.0000E+00
	Loads	21	.6688E+0			.0000E+00		.0000E+00
	Stress		6546E+0			.1170E+04		-87.2
	50.655		10010211		LAR PLATE NO.		100072	0,12
	Loads	24	2089E-0	11365E+0		.0000E+00	.0000E+00	.0000E+00
	Loads	-	-	18686E+0		.0000E+00		.0000E+00
	Loads	27	.9905E+0		•	.0000E+00		.0000E+00
	Stress	MEM	4532E+0		43989E+03	.2174E+04	5138E+03	-81.4
				TRIANGU	LAR FLATE NO.	27		
	Loads	30	3033E-0	11366E+0	2 .0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	27	988BE+0	11757E+0	2 .0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	33	.9919E+0	1 .3123E+0	2 .0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	1471E+0	3 .2759E+0	48425E+03	.2986E+04	3737E+03	-74.9
				TRIANGU	LAR FLATE NO.	28		
	Loads	36	.454BE+0	0 1387E+ 0	2 .0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	33	1028E+0	22698E+0	2 .0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	39	.9826E+0	1 .4085E+0	2 .0000E+00	.0000E+00	.0000E+00	.0000E+00
/	Stress	MEM	.1405E+0		41330E+04	.3920E+04	3276E+03	-70.6
i				· -	LAR FLATE NO.	29***		
	Loads			0 1885E+ 0		.0000E+00		.0000E+00
	Loads		_	23519E+0		.0000E+00	*	. 0 000 E + 00
	Loads	46	.1375E+0	2 .5404E+0	2 .0000E+00	.0000E+00	.0000E+00	.0000E+00

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Loads	Node	Fx	Fy		Fz	М×		My		Mz
Stress	Surf	Sigma X	Sigma	Υ	Tau XY	Sigma	1	Sigma	2	Angle
Stress		Shear XZ	Shear	YZ						
Stress	MEM	.1818E+03	.4603E	+04	1705E+04	.5184E	 +04	3992E	+03	-71.2
			TRIAN	IGULA	AR PLATE NO.	30				
Loads	50	.1212E+02	29548	+02	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	46	2747E+02	3906E	+02	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	54	.1535E+02	. 686°E	+02	.0000E+00	.0000E	+00	.0000E		.0000E+00
Stress	MEM	9206E+03	.5738E	+04	2317E+04	.6465E	+04	164BE	+04	-72.6
					R FLATE NO.	31***				
Loads		7729E+01			.0000E+00	.0000E		.0000E		.0000E+00
Loads	21	-	.53318		.0000E+00	.0000E		.0000E		.0000E+00
Loads	20	.8893E+01	.1516E		.0000E+00	.0000E		.0000E		.0000E+00
Stress	MEM	.8866E+03			.7202E+03	.1220E	+04	6683E	+03	24.9
					R PLATE NO.	32***				
Loads		9917E+01			.0000E+00	.0000E		.0000E		.0000E+00
Loads		4660E+00	.6841E		.0000E+00	.0000E		.0000E		.0000E+00
Loads	26	.103BE+02	.11808		.0000E+00	.0000E		.0000E		.0000E+00
Stress	MEM	.1586E+04	.3364E		.1343E+04	.2442E		519BE	+03	32.5
1	70				AR PLATE NO.	33***		00005	.00	00005100
Loads		9979E+01			.0000E+00	.0000E		.0000E		.0000E+00
Loads		5243E+00	.68846		.0000E+00	.0000E		.0000E		.0000E+00
Loads	32 MEM	.1050E+02	.2056E		.0000E+00	.0000E		4207E		
Stress	MEM	.1887E+04	.9647E		.1789E+04 AR PLATE NO.	.3274E 34***		42U/E	エウク	37.8
1000	71	1067E+02			.0000E+00	.0000E		.0000E	4 ΔΔ	.0000E+00
Loads Loads		1377E+01	35/36 .7362E		.0000E+00	.0000E		.0000E		.0000E+00
Loads	38 38	.1205E+02	.7362E		.0000E+00	.0000E		.0000E		.0000E+00
Stress	MEM	.1203E+02	.1453E		.2291E+04	.4122E		5141E		40.7
201622	r IETT				AR PLATE NO.	35***		101716		4V1/
Loads	42	1715E+02			.0000E+00	.0000E		.0000E	+00	.0000E+00
Loads		3546E+01	.11838		.0000E+00	.0000E		.0000E		.0000E+00
Loads	45	.2069E+02	.22948		.0000E+00	.0000E		.0000E		.0000E+00
Stress	MEM	.2541E+04	.6280E		.2646E+04	4398E		1229E		35.1
					AR PLATE NO.	36***			• .	
Loads	5 0	2447E+02			.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	_	6517E+01	.16888		.0000E+00	.0000E		.0000E		.0000E+00
Loads	53	.3099E+02	.8954E		.0000E+00	.0000E		.0000E		.0000E+00
Stress	MEM	.2653E+04	9 002E	+03	.2693E+04	.4102E	+04	2350E	+04	28.3
			Qt	JAD F	LATE NO. 3	7				
Loads	15	.7188E+01	8515E	+01	.0000E+00	.0000E	400	.0000E	+00	.0000E+00
Loads	16	9875E+01	6407E	E+01	.0000E+00	.0000E	+00	.0000E	+ 00	.00000E+00
Loads	22	43B2E+01	.1011E	+02	.0000E+00	.0000E	+ 00	.0000E	400	.0000E+00
Loads	21	.7069E+01	.4808E	E+01	.0000E+00	.0000E	+ OO	.0000E	+00	.0000E+00

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LTHD inner breach band under 100,000 lb. recoil

	Loads	Node	Fx	v	Fy	.,	Fz	M×		Му	_	Mz
	Stress Stress	Surt	Sigma Shear	X XZ	Sigma Shear	Y YZ	Tau XY	Sigma	1	Sigma	2	Angle
	Stress	MEM	5526	E+03	.7980		.1437E+03		+03	5677E	+03	84.0
			70/0					38***		0000		00005.00
	Loads		3060E				.0000E+00	.0000E		.0000E		.0000E+00
	Loads Loads	22 28	3786E		10116 .1956		.0000E+00	.0000E	-	.0000E	-	.0000E+00
		27					.0000E+00	.0000E		.0000E	_	.0000E+00
	Loads		.43386		.1038		.0000E+00	.0000E		.0000E		.0000E+00
	Stress	MEM	4954	2+02	.1601		.3661E+03	.1679E	+ Q4	1271E	+03	78.0
	1	27	4747					39***		00005		00005.00
	Loads				2895		.0000E+00	.0000E		.0000E		.0000E+00
	Loads	28	23588				.0000E+00	.0000E		.0000E		.0000E+00
	Loads	34	. 2966		.2881		.0000E+00	.0000E		.0000E		.0000E+00
	Loads	33	.37398		. 1970		.0000E+00	.0000E		.0000E		.0000E+00
	Stress	MEM	. 23556	=+02	. 25946		.3586E+03	.2643E	+04	2553E	+02	82.2
			7001					10***				
	Loads		3206				.0000E+00	.0000E		.0000E		.0000E+00
	Loads		3162E		28818		.0000E+00	.0000E		.0000E		.0000E+00
	Loads	40	.12308		.37598		.0000E+00	.0000E		.0000E		.0000E+00
	Loads	39	.51388		. 2911		.0000E+00	.0000E		.0000E		.0000E+00
	Stress	MEM	74886	E+02	.3567		.3405E+03	.3599E	+04	1064E	+03	84.7
				_				11***				
	Loads	39			50738		.0000E+00	.0000E		.0000E		.0000E+00
	Loads				37598		.0000E+00	.0000E		.0000E		.0000E+00
	Loads		72418		.5179		.0000E+00	.0000E		.0000E	_	.0000E+00
	Loads	46	. 1753E		.3654		.0000E+00	.0000E		.0000E		.0000E+00
	Stress	MEM	7095	E+03	.4723	E+04	.5501E+03	.4778E	+04	7646E	+03	84.3
								12***				
	Loads	46	.38036				.0000E+00	.0000E		.0000E	+00	.0000E+00
	Loads	47	2849	E+02	5179	E+02	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
	Loads	55	9600	E+01	. 85858	E+02	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
	Loads	54	.34298	E+02	. 43548	E+02	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
	Stress	MEM	1476	E+04	. 6919	E+04	.1320E+04	.7122E	+04	1679E	+04	81.3
					***Ql	JAD F	LATE NO. 4	13** *				
	Loads	43	34688	E-11	4824	E-11	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
	Loads	44	22518	E+01	35448	E+QQ	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
	Loads	49	. 23028	E+00	.3896	E+01	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
	Loads	48	.20216	E+01	35428	E+01	.00000E+00	.0000E	+00	.0000E	+00	.0000E+00
,	Stress	MEM	15678	E+03	. 43226	E+02	.2745E+03	.2354E	+03	3489E	+03	55.0
							LATE NO. 4	14***				
	Loads	48	20218	E+01	.35428	E+01	.0000E+00	.0000E	+00	.0000E	+ 00	.0000E+00
	Loads	49	44488	E+01	.97826	E+01	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
	Loads	52	.47018	E+01	.3947	E+00	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00

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LTHD inner breach band under 100,000 lb. recoil

	Loads	Node	Fκ	Fy	Fz	Мж	My	Mz
	Stress	Surf	Sigma X	Sigma Y	Tau XY	Sigma 1	Sigma 2	Angle
	Stress		Shear XZ	Shear YZ				
	Stress	MEM	.1959E+02	1625E+04	.7889E+03		1942E+04	21.9
	E33	11611	/W/LTV2	1620E+04 ***QUAD F		5***	• 177ZETU4	21.7
	Loads	44	1372E+01		.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads		969BE+01	4020E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	50	.2281E+01	.2025E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	49	.8788E+01	.9081E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress		5749E+03	.2404E+04	.1258E+04	.2864E+04		69.9
				QUAD F		6	1212 22 107	
	Loads	49	4571E+01	1459E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads		1060E+02	.2881E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	53	.5976E+01	.1936E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
,	Loads	52		7657E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress		3586E+03	.1330E+04	.1724E+04		1434E+04	58.0
	. =				AR PLATE NO.	47***	•	
	Loads	51	1768E+01	.1372E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads		8219E+00	.3664E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	56		1738E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	1417E+03			4652E+02	4335E+04	5.6
			4	***TRIANGULA	AR PLATE NO.	48***		
	Loads	56	.6776E+01	1794E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	52	1643E+02	.1300E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	57	.9656E+01	.4942E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	2743E+04	.1512E+04	.21 66E+ 03	.1523E+04	2754E+04	87.1
					AR FLATE NO.	49***		
	Loads	52		9401E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads		1049E+02	.1157E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	57		2169E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	5786E+03	-	.1621E+04	.1086E+04	2157E+04	45.8
			_	***QUAD F		Q***		
	Loads		9366E+01	.3532E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads		9100E+01	.2848E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	61		1599E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	60		4782E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	.2191E+03	3753E+04	.1086E+04		4031E+04	14.3
			. –	***DUAD F		1***		
	Loads		6846E+01	.4782E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads		1016E+00	.3460E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	65		2986E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads		4946E+00		.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	.6328E+03	4848E+04	.4087E+03	.6631E+03	4B79E+04	4.2

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	Loads Stress Stress	Node Surf	Fx Sigma Shear	X X Z	Fy Sigma Shear	. Y	Fz Tau XY	Mx Sigma		My Sigma	2	Mz Angle
								- <u></u>				
							PLATE NO.	52***				
	Loads	64	. 4946		.5256							.0000E+00
	Loads	65	.15998		.1073							.0000E+00
	Loads		68058									.0000E+00
	Loads		96818									.0000E+00
	Stress	MEM	.3674E	E+03			9698E+03		E+03	3941E	+04	-12.7
							PLATE NO.	53***				
	Loads	76	.96818		.2831							.0000E+00
	Loads	77	.8570		.1829							.0000E+00
	Loads		12088			-						.0000E+00
	Loads		61718				.0000E+00					.0000E+00
•	Stress	MEM	1857E	E+03			1074E+04		E+03	2314E	+04	-26.8
_							PLATE NO.	54***				
	Loads	85	.6171E		.8022							.0000E+00
	Loads	86			1788							.0000E+00
	Loads		7331E				.0000E+00					.0000E+00
	Loads	91	.10848	E-10	3561	E-11	.0000E+00	.0000	E+00	.0000E	+00	.0000E+00
	Stress	MEM	331BE	E+03	3667	E+03	4313E+03	.8238	E+02	7809E	+03	-43.B
					[UAD	FLATE NO.	55				
	Loads		2647E		-			.0000	E+00	.0000E	+00	.0000E+00
	Loads	54	28788	E+02	3120	E+02	.0000E+00	.0000	E+00	.0000E	+00	.0000E+00
	Loads	58	.29386	E+02	.6548	E+02	.0000E+00	.0000	E+00	.0000E	+00	.0000E+00
	Loads	57	. 25888	E+02	.5613	E+01	.0000E+00	.0000	E+00	.0000E	+00	.0000E+00
	Stress	MEM	.5167E	E+02	.3802	E+04	.2955E+04	.5426	E+04	1573E	+04	61.2
							FLATE NO.	56***				
	Loads		3356E					.0000	E+QQ	-		.0000E+00
	Loads	58	2103E	E+02				.0000	E+00	.0000E	+00	.0000E+00
	Loads	62	.36218		.5705							.0000E+00
	Loads	61	.18386		.3292							.0000E+00
	Stress	MEM	.1320E	E+04	.3227				E+04	7977E	+03	54.0
							FLATE NO.	57***				
	Loads		2990E									.0000E+00
	Loads		4617E									.0000E+00
	Loads	66	.3237E		. 4389							.0000E+00
	Loads	65	.21526		. 4957							.0000E+00
	Stress	MEM	. 2392E		.2373					.5368E	20+	44.9
							AR FLATE NO					
	Loads		4797E		. 7059		.0000E+00					.0000E+00
	Loads	69			1454							.0000E+00
	Loads	77	2655E	E+02	.7479	E+01	.0000E+00	.0000	E+00	.0000E	+00	.0000E+00
												1

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LTHD inner breach band under 100,000 lb. recoil

Load Case 1:

	Loads	Node	Fx	Fy	Fz	Мж	My	Mz
	Stress	Surt	Sigma X	Sigma Y Shear YZ	Tau XY	Sigma 1	Sigma 2	Angle
	Stress		Shear XZ	Shear 12				
	Stress	MEM	.6653E+03	.1865E+04	1593E+04	.2967E+04	4369E+03	-55.3
				DUAD F		i9	*	
	Loads	77	.2360E+02	.1177E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	78	.6582E+01	3058E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	87	2361E+02	.7849E-01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	86	6577E+01	.1874E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	9008E+03		1614E+04	.1927E+04	1822E+04	- 6 0.3
				DUAD F		0		
	Loads	86	.1750E+02	.5170E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads			1006E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads		1880E+02		.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	92	.7331E+01	.6234E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	1335E+04		6131E+03	.4698E+03	1543E+04	-71.2
			4.77.5	***DUAD F		1***		
	Loads		1434E+02		.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	55	2755E+02		.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	59 50	.1516E+02	.1118E+03	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads Stress	58 MEM	.2674E+02 1069E+04	.7182E+02	.0000E+00	.0000E+00	.0000E+00 1511E+04	.0000E+00 78.8
	our ess	I-IE-I-I	10076+04	***QUAD F		2***	13116+04	/0.0
	Loads	50	3508E+02		.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	59		1118E+03	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	6 3	.4145E+02		.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	62	.1811E+02	.7720E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	.1476E+Q4	.1207E+05	.3185E+04	.1295E+05	.5926E+03	74.5
					AR FLATE NO.	63***		
	Loads	67	.5315E+02	.2118E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	66	3598E+02	.1609E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	62	1717E+02	3727E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	.9164E+04	.7931E+04	.3652E+04	.1225E+05	.4843E+04	40.2
					AR PLATE NO.			
	Loads	62	3253E+02	7450E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	63		4020E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads	67	.2814E+02	.1147E+03	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	.3196E+04	.1227E+05	.3010E+04	.1318E+05	.2289E+04	73.2
					AR FLATE NO.	65***		
, ·	Loads	68		.1614E+03	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads			5316E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Loads			1083E+03	.0000E+00	.0000E+00	.0000E+00	.0000E+00
	Stress	MEM	.1470E+05	.2328E+05	.9165E+04		★-8868E+04	57.5
		, ,	74505.05	***QUAD F		6***	1	00005.00
	Loads	66	3450E+02	1697E+02	.0000E+00	.0000E+00	J. 0000E+00	.0000E+00
							/	

MAX U,

Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

	Loads	Node	F×		Fy		Fz	M×		My		Mz
	Stress	Surf	Sigma	X	Sigma	Υ	Tau XY	Sigma	1	Sigma	2	Angle
	Stress		Shear	XZ	Shear	YZ						
	Loads	67	.4603E	+02	3825	E+02	.0000E+00	.0000E		.0000E	+00	.0000E+00
	Loads	70	.2134E		.2290E	+02	.0000E+00	.0000E	+00	.0000E		.0000E+00
	Loads	69	3288E		.3231E		.0000E+00	.0000E		.0000E		.0000E+00
	Stress	MEM	.5390E	+04			1227E+04	.6883E	+04	.4381E	+04	-50.6
								57***				
	Loads		4208E		4449E		.0000E+00	.0000E		.0000E		.0000E+00
	Loads	68	.5468E				.0000E+00	.0000E		.0000E		.0000E+00
	Loads	71	.1763E		. 6076E		.0000E+00	.0000E		.0000E		.0000E+00
	Loads		3022E		.61418		.0000E+00	.0000E		.0000E		.0000E+00
	Stress	MEM	.5784E				1354E+04	.1338E		.5543E	+04	-79.9
	1 1	70	20125				AR PLATE NO.			00000		00005.00
(Loads	72	.2818E		.7143E		.0000E+00	.0000E		.0000E		.0000E+00
•	Loads	71	.2497E		.12298		.0000E+00	.0000E		.0000E		.0000E+00
	Loads		5315E				.0000E+00	.0000E		.0000E		.0000E+00
	Stress	MEM	.4509E	.+Q4	.18018		.1143E+05	.2453E	ナロン	2016E	+04	60.3
	1		. 100ac					59***		0000=		00005+00
	Loads		1923E		1763B		.0000E+00	.0000E		.0000E		.0000E+00
	Loads	70			3657E		.0000E+00	.0000E		.0000E		.0000E+00
	Loads		5376E		.24518		.0000E+00	.0000E		.0000E		.0000E+00
	Loads		3689E		. 29688		.0000E+00	.0000E		.0000E		.0000E+00
	Stress	MEM	.4489E	+03	.57658		9643E+03	.5935E	+04	.2794E	+03	-80.0
		70	21005		+++6/L 4775E			70***		0000		00005+00
	Loads		2109E 1592E				.0000E+00	.0000E		.0000E		.0000E+00
	Loads						.0000E+00	.0000E				
	Loads	80	.5929E		.48108		.0000E+00	.0000E		.0000E		.0000E+00
	Loads	79 MEM			.2352E		.0000E+00	.0000E		.0000E		77.7
	Stress	i i E i i	7990E	ナリン				.8122E 71***	~U4	1220E	TU4	//•/
	Loade	71	- 24405	***			.0000E+00	.0000E	+ 00	.0000E	±00	.0000E+00
	Loads Loads		2668E		47176 .8736E		.0000E+00	.0000E		.0000E		.0000E+00
		81	4789E		.12878		.0000E+00	.0000E		.0000E		.0000E+00
	Loads Loads	80	.2733E				.0000E+00	.0000E		.0000E		.0000E+00
	Stress		1484E				.8018E+04			1092E		40.4
	201622	11(5.11)	* 1404E	- C/4				. 2001E	~U 4			→∨• →
	Loads	72	19715	+02	.63418		.0000E+00	.0000E	+ ∆0	MW.	+00	.0000E+00
	Loads	73	.17/1E		.59188		.0000E+00	.0000E		.0000E		.0000E+00
	Loads		1619E				.0000E+00	.0000E		.0000E		.0000E+00
	Loads		7357E				.0000E+00	.0000E		.0000E		.0000E+00
*	Stress						2479E+04					-19.1
	-C1 E33	116.17	. ,000					73***		.01000		4 / • •
	Loads	73	3834E	+01			.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
,		· -	/ -				3 4 4 4 W W . W W			# 4 4 4 4 A	- ·	

Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

Load Stre Stre	ess Surf	Fx Sigma X Shear XZ	Fy Sigma Y Shear YZ	Fz Tau XY	Mx Sigma 1	My Sigma 2	Mz Angle
Load		.1229E+01	.3228E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load	ds 83	.3545E+01	.3179E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load	is 82	9392E+00	.2416E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stre	ess MEM	.3818E+03	.6016E+03	.2801E+03	.7926E+03	.1908E+03	55.7
			QUAD P	LATE NO. 7	′4		
Load	is 74	1229E+01	3228E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load	is 75	4012E-12	2740E-11	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load	ls 84	.5121E+00	.1634E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load	ds 83	.7164E+00	1311E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stre	ess MEM	.4097E+02	.3434E+02	.1307E+03	.1684E+03	9309E+02	44.3
		+	***TRIANGULA	R FLATE NO.	75***		
Load	is 78	.1907E+02	1677E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load	ds 79	2159E+02	.5064E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load	ds 87	.2518E+01	.1171E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stre	ess MEM	2285E+04	.2492E+04	.5358E+03	.2551E+04	2344E+04	83.7
		+	***TRIANGULA	R FLATE NO.	76***		
Load	ts 80	1642E+02	2525E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load	ds 81	.5359E+01	.2248E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load	ds 88	.1106E+02	.2773E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stre	ess MEM	.5671E+03	.5964E+03	.2379E+04	.2961E+04	1797E+04	45.2
		•	***TRIANGULA	R FLATE NO.	77 ***		
Load	ts 82	.7616E+01	.1599E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load		3897E+01	7558E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load		3719E+01	8437E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stre	ess MEM	4124E+03		7998E+03		2177E+04	-24.4
			***TRIANGULA				
Load	ds 88	7518E+01	.1975E+02	.0000E+00	.0000E+00		.0000E+00
Load	is 87	.1409E+02	.6331E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load		6571E+01		.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stre	ess MEM	1145E+04	.2790E+04	.7028E+03	.2911E+04	1267E+04	80.2
			***TRIANGULA				
Load		.4790E+01	.6505E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load		.6575E+01	1645E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load			.9946E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stre	ess MEM	8808E+02		.1209E+04	.7296E+03	1876E+04	34.1
_			***TRIANGULA				
Load		· · · -	4086E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load			3746E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Load			.4154E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stre	ess MEM	1660E+02	4443E+03	.1754E+03	.4613E+02	5070E+03	19.7

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Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

Load Case 1:

	Loads	Node	Fx		Fy	,	Fz	М×		Му		Mz
	Stress	Surf	Sigma	X	Sigma		Tau XY	Sigma	1	Sigma	2	Angle
	Stress		Shear		Shear			-		-		
							AR FLATE NO.					
	Loads	79			2701		- -	.0000E		.0000E		.0000E+00
	Loads		3473		.2819			.0000E		.0000E		.0000E+00
	Loads	88			1183		.0000E+00	.0000E		.0000E		.0000E+00
	Stress	MEM	2269				.2858E+04	.1769E	-	4292E	+04	54.7
			4500				AR PLATE NO.			00005		6000E.00
	Loads	81						.0000E		.0000E		.0000E+00
	Loads	82	.9514		.1849			.0000E		.0000E		.0000E+00
	Loads	89			5620		.0000E+00	.0000E		.0000E		.0000E+00
	Stress	MEM	. 16911		1183		.1362E+04	.2234E		1726E	+04	21.7
		0.7	107/1				AR PLATE NO.			0000		000000.00
	Loads	83	.1276		.1536		.0000E+00	.0000E		.0000E		.0000E+00
•	Loads		51218					.0000E		.0000E		.0000E+00
	Loads		7637E				.0000E+00 1625E+03	.0000E		.0000E 2373E		.0000E+00 -57.8
	Stress	MEM	1350	5+03				.1232E	.+U.S	23/36	.+03	-3/.8
	Landa	87	13036	=±00	8061		.0000E+00	.0000E	***	.0000E	·+00	.0000E+00
	Loads Loads		19788		.1078		.0000E+00	.0000E		.0000E		.0000E+00
	Loads		12048				.0000E+00	.0000E		.0000E		.0000E+00
	Loads	93	.18808		.1345		.0000E+00	.0000E		.0000E		.0000E+00
	Stress	_	17116		.3734		.3611E+03	.4342E		1772E		BO. 4
	JU ESS	116.11	1/110	_+0+			-	. 70726 5***	. + Q.5	1//26	. 	OV. 4
	Loads	88	36288	=+01			.0000E+00	.0000E	+00	.0000E	-00	.0000E+00
	Loads		B104E		.8877		.0000E+00	.0000E		.0000E		.0000E+00
	Loads		3120		.2730		.0000E+00	.0000E		.0000E		.0000E+00
	Loads	94			5638		.0000E+00	.0000E		.0000E		.0000E+00
	Stress		4525				.6241E+03	.3380E		9452E		51.7
	00.013		• .5250					86***		.,,,,,,,		0117
	Loads	89	4170E	E+00			.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
	Loads	90	.1050E		.3104			.0000E		.0000E		0000E+00
	Loads	96	.12718		.792		.0000E+00	.0000E		.0000E		.0000E+00
	Loads	95			2730		.0000E+00	.0000E		.0000E		.0000E+00
	Stress	MEM	.56438	E+01	1460	E+03	.1669E+02	.7457E	+01			6.2
				4	***TRIA	NGUL	AR PLATE NO.	87***				
	Loads	65	20798	E+02	.1158	E+02	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
	Loads	66	.38118	E+02	4301	E+02	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
,	Loads	69	17336	E+02	.3143	E+02	.0000E+00	.0000E	+00	.0000E	+ 00	.0000E+00
	Stress	MEM	.3326	E+04	.3361	E+04	1853E+04	.5197E	+04	.1490E	+04	-45.3
				+	***TRIA	NGUL	AR PLATE NO.	88***				
	Loads	78	2197E	E+02	.1768	E+02	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
	Loads	77	.1180	E+01	.1389	PE+02	.0000E+00	.0000E	+00	.0000E	+ 00	.0000E+00

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Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

Load Case 1:

Loads	Node	F×	Fy	Fz	Мж	My	Mz
Stress	Surf	Sigma X	Sigma Y	Tau XY	Sigma 1	Sigma 2	Angle
Stress		Shear XZ	Shear YZ				_
Loads	69	.2079E+02	3157E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	1888E+03	.3377E+04	2223E+04	.4444E+04	1256E+04	-64.4

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SOLVE FLATE LOADS/STRESSES Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

Load Case 1:

MAXIMUM STRESS SUMMARY FOR FLATES WITHIN SPECIFIED RANGE

Maximum (absolute) Stress = .2328E+05 at Plate 65

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SOLVE REACTIONS

Version 1.1 02/01/85

LTHD inner breach band under 100,000 lb. recoil

Load Case 1:

REACTIONS

Node	Fx	Fy	Fz	M×	My	Mz
3	.2507E+00	.0000E+00	.0000E+00	00005100	00005100	00005.00
_		• •		.0000E+00	.0000E+00	.0000E+00
6	.7847E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
9	2840E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
12	1234E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
16	1822E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
22	8168E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
28	.1495E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
34	1958E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00

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COMBINE RESULTS Version 1.3 03/08/86

Combined Reactions

Load Combination Method

File switched to IBBAND.REA Load Case 1
Factor 1

Node	F×	Fy	Fz	Msc	My	Mz
3	2.507E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
6	7.847E-01	0.000E+00	0.000 E+ 00	0.000E+00	0.000E+00	O.000E+00
9	-2.840E+00	0.000£+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
12	-1.234E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Combined Reactions

				COME	TINE O THE	SC CI U	· · · -					
Iff	ले के ले ज़ भारत है।	т өмммөмим	ифинин	ининини.	зинининин	inidan	иниииииииииииииииииииииииииииииииииии	помні	HMMHHH	140111	HHHHHH	144:
:	Node	: Fn	.3	Fy :	8 F:	3	Mix	3	M_{Y}	3	ME	:
LM	MMMMMMMM	न् र ल ल ल ल ल ल ल हा हु ।	HHMMSH	ммммнис	OMMMMMMINI THE MEMORIAL OF THE MEMORIAL OF	1H110H	HMMHHMMM	110 H 111	4444444	1/1/2 /1 /1	MISHAM	111113
:	3	2.507E-0	1 0.0	00E+00	0.000E+	FOO.	0.000 E+ 0	o o,	,000E+0	θQ Q	, OOOE•	(O);
:	6	7.847E-0	1 0.0	00 E+ 00	0.000E	⊬OŌ	0.000E+0	$\mathbf{o} = \mathbf{o}$.000E+0	$\phi = \phi$.000E+	FQQ:
:	9	-2.840E+0	0.0	00 E+ 00	0.000E	FQQ	0.000E+0	o o ,	.000E+0	oo o	.000E∢	FOO:
:	12	-1.234E+0	1 0.0	00E+00	0.000E	F QQ	0.000 E+ 0	o o .	,000E+0	ϕ (.000E+	FQQ:
:	1 🖘	-1.822E+0	1 0.0	00 E+ 00	0.000E+	ΕΦΦ	0.000 E+0	o o .	.000E+0)O C	.000E+	OO:
:	22	-8.168E+0	0.0	00 E+ 00	0.000E-	F QQ	0.000E+0	0 0.	.000E+0)() ()	.000E	FQQ:
:	28	1.495E-0	1 0.0	00 E+ 00	0.000E-	FOO .	0.000 E+0	o o .	.000E+0	op O	.000E+	FQQ:
:	34	-1.958E-0	1 0.0	00 E+ 00	0.000E	FQQ.	0.000E+0	o o.	,000E+0)O C	.OQQE∢	FQQ:
:	4 🔆	-9.834E+0	0.00	00 E+ 00	O.OOOEH	FOO	0.000E+0	o o.	.000E+0	oo o	.000E+	FOO:
:	47	-3.573E+0	1 0.0	00 E+ 00	0.000E-	FQQ	0.000 E+ 0	o o.	,000E+0	jo o	.000E+	F00#
:	55	-3.715E+0	1 0.0	00 E+0 0	0.000E+	FOO	0.000 E+0	o o .	.000E+0	90 o	.000E+	100
:	5.9	-9.309E+0	0.0.0	00 E+ 00	O.OOOE-	FOO	0.000E+0	o o,	.000E+0) () ()	.000E	FOO;
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DESCRIPTION: ENVIRONMENTS AND LOAD CONDITIONS

The following environments and load conditions were identified and evaluated:

- 1. Fire Position Static
- 2. Fire Position Dynamic
- I. Speedshift
- 4. Helicopter Transport
- 5. Frime Mover (Truck) Transport
- o. Aircraft Transport
- 7. Low-Velocity Farachute Deployment
- 8. LAFES Deployment
- 9. Rail Transport
- 10. Damage Tolerant Loading

Details include:

1. Fire Position - Static

Hand-calculations were performed to determine the cradle, platform, gimbal and trail loading due to an equilibrated barrel at both 0 and 72 degrees 0E. Simple computer models were also used to determined worst-case trail loading at 22.5 degrees traverse and 0 degrees 0E.

2. Fire Position - Dynamic

Two major dynamic loads were considered:

Recoil force. A value of 79,000 lbs for maximum recoil force was calculated by hand using recoil component weight, stroke length, projectile weight, projectile velocity at shot ejection. This value assumes using a FIMF charge.

Rifling torque. A value of 42.500 lb-sec was determined for the peak rifling torque. This also assumes the use of a PIMP charge.

This value, while used as working design, should have been used as limit design point. As a result the structural areas affected by this are overdesigned. The working design should be roughly 27,000 ft-lbs.

Both of these loads were used as inputs into the system which were ultimately transmitted through the major components and into the ground.

J. Speedshift

The major speedshift load is the 9000 lbs acting on the speedshift assembly and cradle. In addition, a damage tolerant

load for the trails was determined which accounted for the possibility of the trails hitting a tree, rock or other obstacle during the speedshift rotation.

4. Helicopter Transport

These loads were dictated by the LTHD having to meet the requirements of MIL-STD-209F, "Slinging and Tiedown Provisions for Lifting and Tving Down Military Equipment." The loads are described in Section 4.8 of this report, Slinging and Tiedown Provisions.

5. Frime Mover (Truck) Transport

Assumptions were made regarding the limitations of the LTHD during towing. A "bump and skid" load was determined to represent the load that, if exceeded, would cause a rollover.

E. Aircraft Transport

Documents on the air transport of military equipment were used to determine worst-case G-loading conditions.

7. Low-Velocity Parachute Deployment

G-loads from a document on this subject were used as inputs to the sitem to determine component load values.

8. LAFES Deployment

G-loads from documents on LAPESing were used as inputs to the system and major components.

9. Pail Transport

Documents on rail transport, rail car impact test requirements, and the MIL-STD on tiedowns were used to estimate G-loading values for this severe environment.

10. Damage Tolerant Loading

As appropriate, load magnitudes and their paths were determined which represented possible non-operating and accidentally-induced loads. These situations included side loading on the trails during speedshift and side loading on the fire control linkage and brunnion due to their exposed location.

STATUS:

Calculations of the load values for each of the environments

listed below can be found in the individual component sections. The "Book of Loads," found in the boxes of LTHD shutdown documents also contains this current information and old calculations as well.

AUTHORS: Scott Dacko, Larry Libhardt

LOAD CONDS 1,2,3,4

FMC LTHD NON-FIRING LOAD CONDITIONS

FIRE POSITION (EMPLACED)

LTHD STRUCTURE TO WITHSTAND WITHOUT PERMANENT DEFORMATION THE STATIC LOADS FROM ITS INTERNAL COMPONENTS (E.G., EQUILIBRATORS) AT ALL BARREL ORIENTATIONS INCLUDING:

0 DEG QE, 0 DEG TRAV 0.DEG QE, 22.5 DEG TRAV 72 DEG QE, 0 DEG TRAV 72 DEG QE, 22.5 DEG TRAV CONSTRAINTS: FIRE (OR EMPLACED) POSITION.

SOURCE: LOAD CONDITION RESULTING FROM FMC LTHD DESIGN.

LTHD 29 OCTOBER 1986 54

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FMC LTHD FIRING LOAD CONDITIONS

LTHD STRUCTURE TO WITHSTAND WITHOUT PERMANENT DEFORMATION A MAXIMUM RECOIL FORCE OF 79,000 LBS AND A MAXIMUM RIFLING TORQUE OF 42,416

DESIGNED RIFLING TORQUE-TIME PROFILE HAVING A MAXIMUM RIFLING LTHD STRUCTURE TO WITHSTAND THE DESIGNED RECOIL FORCE-TIME PROFILE HAVING A MAXIMUM RECOIL FORCE OF 62,000 LBS AND THE TORQUE OF 26,000 FT-LBS.

LOADS ARE APPLIED AT ALL BARREL ORIENTATIONS, INCLUDING 0 DEG QE, 0 DEG TRAV 0 DEG QE, 22.5 DEG TRAV 72 DEG QE, 0 DEG TRAV 72 DEG QE, 22.5 DEG TRAV

CONSTRAINTS: FIRE POSITION, WITH TWO GROUND CONDITIONS:
HARD GROUND, SPADE HOLDS 100\$
SOFT GROUND, SPADE HOLDS 68%, EACH CLAW HOLDS 16%

RESULTING FROM FIRING HOT, ZONE 8S W/ XM795 PROJECTILE. 79,000 LBS - FMC ESTIMATE OF 105% PIMP CONDITION. 42,416 FT-LBS - ARDEC ESTIMATE OF 105% PIMP CONDITION. TIME-PROFILES - FMC ESTIMATE OF DYNAMIC CONDITIONS SOURCE:

LTHD 29 OCTOBER 1986 SD

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(1040 CAND. 9 (TOWING)

PRIME MOVER (TRUCK) TRANSPORT

LB HORIZONTAL PULL AT THE LUNETTE CONCURRENT WITH THE FRONT WHEELS OF THE WALKING BEAMS HITTING ROAD OBSTACLES SUCH THAT THE REAR WHEELS LTHD STRUCTURE TO WITHSTAND WITHOUT PERMANENT DEFORMATION AN 18,000 START TO LIFT OFF THE GROUND.

LB HORIZONTAL PULL AT THE LUNETTE COMBINED WITH A 0.8 G LATERAL LOAD LTHD STRUCTURE TO WITHSTAND WITHOUT PERMANENT DEFORMATION A 9,000 AT THE WHEELS.

TOW POSITION. LUNETTE LOCKED TO PRIME MOVER PINTLE. CONSTRAINTS:

SOURCE: FMC ESTIMATES OF WORST-CASE TOWING CONDITIONS.

LTHD 29 OCTOBER 1986 SD

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LAAD COND. 10

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AIRCRAFT TRANSPORT

LTHD STRUCTURE TO WITHSTAND WITHOUT PERMANENT DEFORMATION 2 G'S IN THE UPWARD DIRECTION, 4.5 G'S IN THE DOWNWARD DIRECTION, 3 G'S IN REARWARD DIRECTIONS (AIR DROP), AND 1.5 G'S LATERALLY.

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CONSTRAINTS: TOW POSITION. MINIMUM OF FOUR TIEDOWN PROVISIONS.

SOURCES: MIL-A-8421F, 25 OCTOBER 1974, "AIR TRANSPORTABILITY REQUIREMENTS, GENERAL SPECIFICATIONS FOR."

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COND. 12

LOAD

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(HIGH ALTITUDE) LOW VELOCITY PARACHUTE DEPLOYMENT

LTHD STRUCTURE TO WITHSTAND WITHOUT PERMANENT DEFORMATION A LOAD OF 18.5 G'S IN THE DOWNWARD DIRECTION.

CONSTRAINTS: TOW POSITION WITH WHEELS RETRACTED. SUPPORTED AT BOTTOM OF CRADLE, TRAILS AND PLATFORM WITH CRUSHABLE PALLET.

SOURCE: "AIR TRANSPORTABILITY CRITERIA FOR TRACKED COMBAT VEHICLES," BY D. WILSON. FMC CORPORATION.

29 OCTOBER 1986 LTHD

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LAPES DEPLOYMENT

LTHD STRUCTURE TO WITHSTAND WITHOUT PERMANENT DEFORMATION:

- A. 6 G'S IN DOWNWARD DIRECTION AT REAR OF PALLET AT 15 DEGREES TO HORIZONTAL.
- B. FOLLOWED BY 20 G'S IN DOWNWARD DIRECTION AT FRONT OF PALLET WITH PALLET HORIZONTAL.

CONSTRAINTS: TOW POSITION WITH WHEELS RETRACTED. SUPPORTED AT BOTTOM OF CRADLE, BARREL, TRAILS, AND PLATFORM WITH COLLAPSABLE PALLET.

CONVERSATIONS WITH "AIR TRANSPORTABILITY CRITERIA FOR TRACKED COMBAT BY D. WILSON. FMC CORPORATION. CONVERSATIONS SOURCES: "/ D. WILSON. LTHD 29 OCTOBER 1986

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RAIL TRANSPORT LOADS

LTHD STRUCTURE TO WITHSTAND WITHOUT PERMANENT DEFORMATION 15 G'S FORWARD AND BACKWARD.

SHARE OF 9,000 IN THE FORWARD AND BACKWARD DIRECTIONS, 2.0 TIMES ITS PROPORTIONATE SHARE IN THE UPWARD DIRECTION AND 1.5 TIMES ITS 4.0 TIMES ITS PROPORTIONATE LTHD STRUCTURE TO WITHSTAND WITHOUT PERMANENT DEFORMATION LOADS PROPORTIONATE SHARE IN THE LATERAL DIRECTION. LOADS APPLIED STATICALLY AND INDEPENDENTLY AT SYSTEM C.G. AT EACH TIEDOWN PROVISION EQUAL TO:

ULTIMATE STRENGTH OF LTHD TIEDOWN PROVISIONS AND STRUCTURAL FRAME TO BE NOT LESS THAN 1.5 TIMES THE YIELD STRENGTH.

PROVISIONS. (ALTERNATIVE: WHEELS RAISED INTO TRAILS, 4+ TIEDOWNS.) TOW POSITION, WHEELS BLOCKED, MIN. OF FOUR TIEDOWN CONSTRAINTS:

SOURCES: FMC ESTIMATE OF G-LOADING TO BE EXPERIENCED IN RAIL CAR IMPACT TEST. (MIL-STD-810D, 19 JULY 1983, METHOD 516.3, SHOCK, PROCEDURE VIII - RAIL IMPACT.)

CLASS II TIEDOWN MIL-STD-209F, 5 SEPTEMBER 1984, "SLINGING AND TIEDOWN PROVISIONS FOR LIFTING AND TYING DOWN MILITARY EQUIPMENT." CLASS II TIEDOWN PROVISIONS. 29 OCTOBER 1986

HELICOPTER TRANSPORT

LOAD AT EACH SLINGING PROVISIONS EQUAL TO 3.2 TIMES ITS PROPORTIONATE LTHD STRUCTURE TO WITHSTAND WITHOUT PERMAMENT DEFORMATION A WORKING ULTIMATE STRENGTH OF LTHD STRUCTURE TO BE NOT SHARE OF 9,000 LBS. ULTIMATE STRENGTI LESS THAN 1.5 TIMES THE WORKING LOAD.

TWO AT FORWARD CONSTRAINTS: TOW POSITION, FOUR SLINGING PROVISIONS: TWO AT FORW MANIFOLD, TWO AT REAR PLATFORM. TRUE ANGLE OF SLING LEG MUST NOT APEX TO BE ABOVE C.G. AND LESS 45 DEGREES FROM VERTICAL. THAN 24 FEET FROM GROUND.

SOURCE: MIL-STD-209F, 5 SEPTEMBER 1984, "SLINGING AND TIEDOWN PROVISIONS FOR LIFTING AND TYING DOWN MILITARY EQUIPMENT." CL I SLINGING PROVISIONS, TYPE II EQUIPMENT. LTHD 29 OCTOBER 1986

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COND. 15

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SPEEDSHIFT

LTHD STRUCTURE TO WITHSTAND WITHOUT PERMANENT DEFORMATION A 9,000 LB WEIGHT AT THE SPEEDSHIFT ASSEMBLY, ALONG WITH 500 LB HORIZONTAL FORCE INPUTS PERPENDICULAR TO THE LUNETTE, CLAWS AND PLATFORM.

SYSTEM WEIGHT ON SPEEDSHIFT ASSEMBLY, TRAILS SPREAD. CONSTRAINTS:

SOURCE: FMC ESTIMATE OF WORST-CASE LOADING CONDITION.

LTHO 29 OCTOBER 1986

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DESCRIPTION: MANIFOLD TORQUE ANCHORS

STATUS:

24,44,644 . A 22,24,255

An FEA model was created to analyze the strength of the manifold torque anchor design. Results indicate that a factor of safety of 3.06 is obtained when an aluminum alloy with yield strength of 55,000 psi is used for the manifold material. The following pages of this section contain the details of this analysis.

AUTHOR: Joe Fishbein

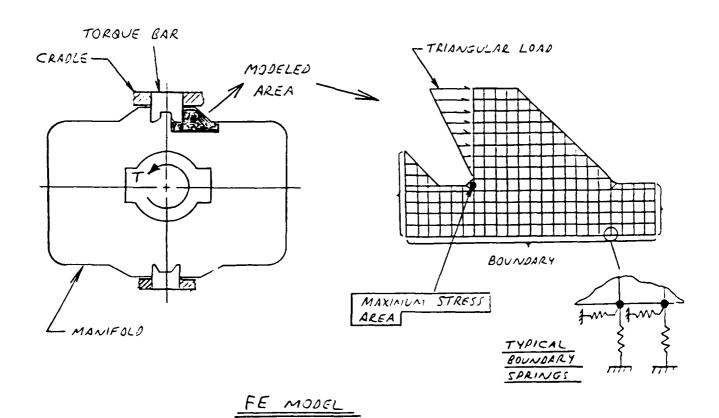
MANIFOLD

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The manifold, in addition to its other functions, transmits the rifling torque from the barrel/rail assembly to the cradle. This is accomplished with bars at the top and bottom, which engage projections on the manifold, and bear against the cradle openings.

This projection on the manifold was analyzed by modeling a cross section through this area. Since the loading on the bar is eccentric, a triangular load distribution on the manifold projection was assumed. The model is attached to the rest of the manifold by springs to ground in both directions at each node point on the boundary (The spring constant was estimated with a simple test model).

Maximum stresses occur in the corner at the base of the projection. Maximum stress is 18,000 PSI. Although the exact Aluminum alloy used for the manifold has not been selected yet, a yield strength of 55,000 PSI is required for other manifold loads, resulting in a FS of 3.06.



LTHO 717 2/17/

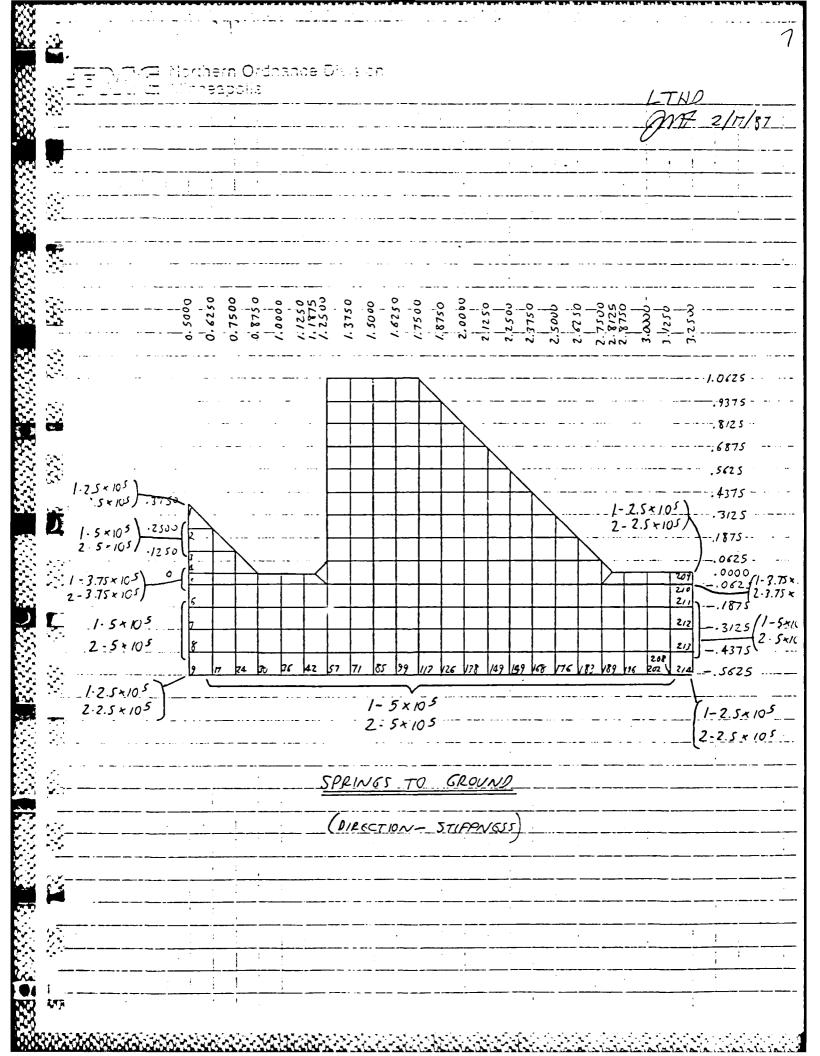
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2. 4.5G AIR DROP	·- · · · · · · · · · · · · · · · · · ·
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H. MANIFOLD TORQUE PINS	٠٠٠
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PART NUMBERS: 12585766, Muzzle Brake machining, 12585765, Muzzle Brake casting

DESCRIFTION: MUZZLE BRAKE WITH INTEGRAL LUNETTE

The muzzle brake shape is identical to that of the M198 muzzle brake with the exception of a lunette addition. The material was changed to TI6AL4V to provide a total after-machined weight of 181 lbs--a reduction of over 80 lbs from the current M198 muzzle brake.

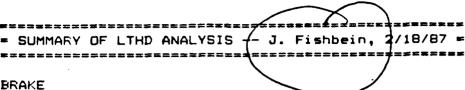
STATUS:

Both casting and machining drawings for the FMC LTHD muzzle brake (TDP, Dwgs. 12585765, 12585766) are complete and ready to build from. FMC has worked closely with Titech to finalize all drawing notes and requirements for these drawings.

A preliminary investigation was performed to determine the extent of material corrosion caused by the high pressures and temperatures present as well as from particle impact on the muzzle brake baffles. No conclusive data was compiled, but all evidence suggested that titanium would survive the environment better than steel.

Additional analysis included the creation of an FEA model to determine the effect of temperature changes on stresses at the muzzle-tube interface. A comparison of a steel brake on a steel tube with a titanium brake on a steel tube was made and it was concluded that acceptable stress levels are obtained in the titanium muzzle brake. This thermal stress analysis is found on the following pages of this section.

AUTHORS: Joe Fishbein, Larry Libhardt, Suellen Halverson



1) MUZZLE BRAKE

The muzzle brake was analyzed for hoop stresses in the thread engagement region with the barrel. This was done for both internal pressure loading and differential temperature. A comparison was made between steel and titanium muzzle brakes.

The pressure load case was analyzed by hand, using formulas in Roark (Table 32-1a,1c). The barrel is loaded with the 11,000-PSI internal pressure, and an unknown external pressure. The muzzle brake is loaded with the unknown internal pressure. By applying displacement compatibility (Change in barrel OD = change in brake ID), the unknown pressure may be determined, and thus the brake stresses. Below is a summary of results:

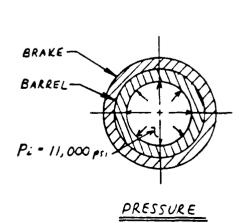
Item		Titanium Brake

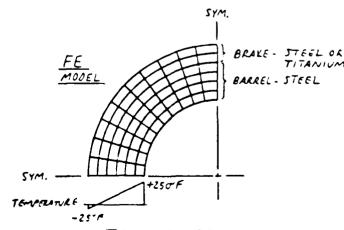
Fressure at Interface	2,483 FSI	1,569 FSI
Expansion at Interface	.0060 in.	.0069 in.
Hoop Stress in Erake	21,177 FSI	13,379 FSI

For the thermal stress analysis, a Finite Element Model of the cross-section of the barrel and brake was assembled. Six rows of elements were used through the thickness. Each row was loaded with a temperature, based on a linear gradient from +250-deg. F. (internal) to -25-deg. F. (external). A summary of the resulting stresses is given below:

Item	Steel Brake	Titanium Brake
*======================================		
Maximum Radial Stress-Barrel	-2,475 PSI	-2,050 FSI
Maximum Radial Stress-Brake	-1,515 FSI	-1,050 FSI
Maximum Hoop Stress-Barrel	-23,460 PSI	-20,795 FSI
Maximum Hoop Stress-Brake	20,620 PSI	13,770 PSI

All stresses are well within the allowable for titanium (Yield stress = 120,000 FSI).





TEMPERATURE

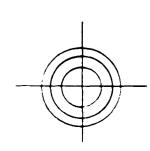
APPLIED MECHANICS

LTHD

Analyst	1115
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MUZZLE BEAKE



Q: FRETILE @ INTERESE P:= 11,000 ps/ = 0 = change of Rome @ "

(RURAK, TIELE 32-14, 10)

$$\frac{AARET.2}{F} \Delta(r.) = \frac{41}{F} \left(\frac{221^2}{2^2 - 1^2} \right) = \frac{Q_2}{F} \left(\frac{2^2 + e^2}{2^2 - e^2} - 2^2 \right)$$
 (1)

$$\frac{\partial z_{i,k}}{E} \Delta(r_i) = \frac{Qt}{E} \left(\frac{a^2 + i^2}{2^2 + a^2} + 2r \right)$$
 (2)

A) STATE BUCKE TERE BLAKE

(1)
$$\Delta = .0054 - 9.5742 \times 10^{-7} \otimes$$

$$\Delta$$
 (248. - +300. Δ

$$\Delta = .0060.60$$

$$Q = .2483 p .2$$

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4 APPLIED MECHANICS

LTHO	Analyst 9 14	=
	Project Number	
	EC No	7



TRUSENTAL STRESS - JE

$$\overline{J_2} : \frac{Q(2^2 - k^2)}{(2^2 - k^2)} = \frac{21177 psi}{}$$

E) STEEL CARREL TITANING BRAKE

(1)
$$\Delta = 4.4147 \times 10^{-6} Q$$

 $Q = 2265/6 \Delta$ (2)

$$\Delta = .0034 - .273 \Delta$$
 $1.2173 \Delta = .0084$

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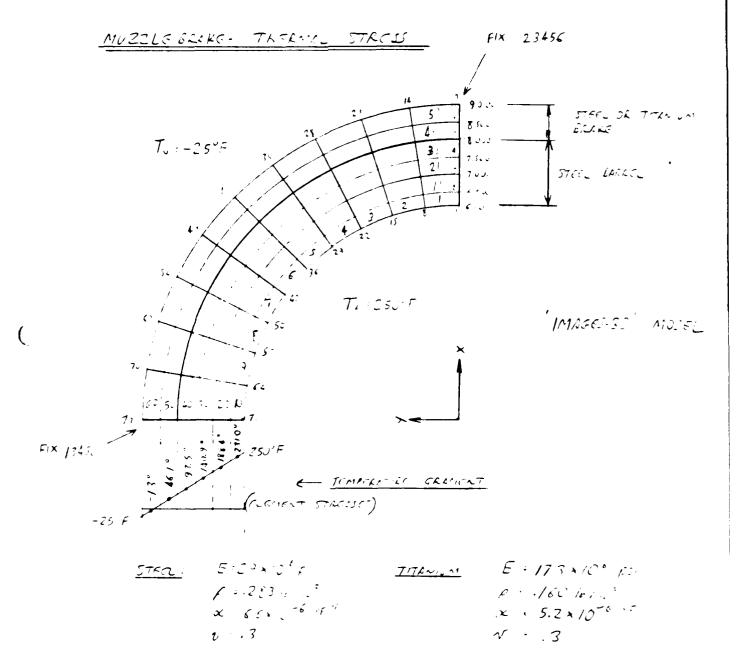
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APPLIED MECHANICS

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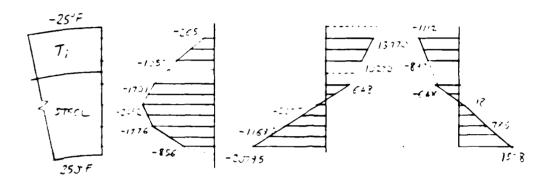
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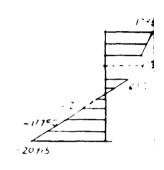
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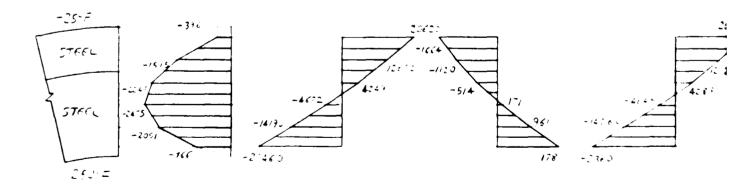
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LTHO MUZZZLE BRAKE

- 1) STEEL BARREL, TITANIUM BRAKE
- 2) STEEL BARREL, STEEL BRAKE

THERMAL STRESS, To = -25°F

Ti: 250°F

TREF: -25°F

IMAGES-3D FEA

01-12-1987 PAGE 1

========== I M A G E S 3 D ==============

RENUMBER NODES

Version 1.1 02/01/85

LTHD muzzle brake thermal load - titanium

Node Renumbering Cross Reference List

Was	Is	Was	Is	Was	Is
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4	4	5	5	6	6
7	7	8	8	9	9
10	10	1 1	11	12	12
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Original Nodal Band

Final Nodal band

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ASSEMBLE STIFFNESS MATRIX Version 1.1 02/01/85

LTHD muzzle brake thermal load - titanium

STIFFNESS ASSEMBLY SUMMARY

BLOCK NUMBER 1

FORM Matrix
PACH Matrix
Size = 13864 Evtes
TRIANGULARIZE Matrix

BLOCK NUMBER 2

ASSEMBLE STIFFNESS MATRIX Version 1.1 02/01/85

LTHD muzzle brake thermal load - titanium

CROSS REFERENCE LIST

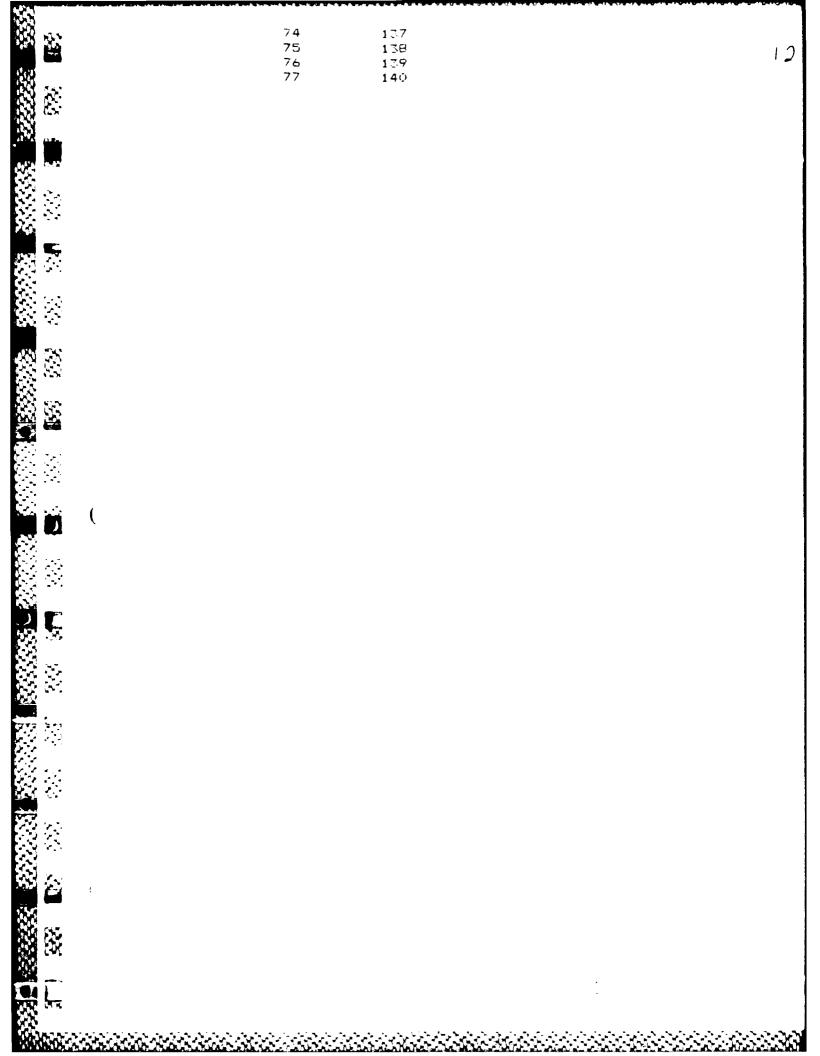
Is Node Verus Internal Equation Number

Is Node		ANSLAT		/	F	ROTATI	
14006	Eqn.	Eqn.	Ean.	′,	Eqn.	Eqn.	Eqn.
1	1			/			
2 3 4	2 3 4						
4	4						
5	5						
6	6						
7	7						
8	8	9					
9	10	1 1					
10	12	13					
11	14	15					
12	16	17					
1 🖪	18	19					
14	20	21					
15	22	23					
16	24	25					
17	26	27					
18	28	29					
19	30	31					
20	32	33					
21	34	35					
22	36	37					
23	38	39					
24	40	41					
25	42	43					
26	44	45					
27	46	47					
28	48 50	49					
29	50	51					

ASSEMBLE STIFFNESS MATRIX Version 1.1 02/01/85

LTHD muzzle brake thermal load - titanium

Is	TR	ANSLAT	ION	/		ROTATI	DN
Node	Eqn.	Egn.	Eqn.	1	Eqn.	Egn.	Egn.
				1			
40	72	73					
41	74	75					
42	76	77					
43	78	79					
44	80	81					
45	82	83					
46	84	85					
47	86	87					
48	88	89					
49	90	91					
50	92	93					
51	94	95					
52	96	97					
53	98	99					
54	100	101					
55	102	103					
56	104	105					
57	106	107					
58	108	109					
59	110	111					
6 0	112	113					
61	114	115					
62	116	117					
63	118	119					
64	120	121					
6 5	122	123					
66	124	125					
67	126	127					
68	128	129					
69 7.5	130	131					
70	132	133					
71		134					
72		135					
73		136					



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SOLVE DISPLACEMENTS Version 1.1 02/01/85

LTHD muzzle brake thermal load - titanium

LOAD CASE 1

REFERENCE TEMPERATURE =-.2500E+02

FLATE TEMPERATURES

Flate	Temp	Flate	Temp	Flate	Temp	Flate	Temp
1	.2310E+03	2	.2310E+03	3	.2310E+03	4	.2310E+03
5	.2310E+03	6	.2310E+03	フ	.2310E+03	8	.2310E+03
9	.2310E+03	10	.2310E+03	11	.1884E+03	12	.1884E+03
13	.1884E+03	14	.1884E+03	15	.1884E+03	16	.1884E+03
17	.1884E+03	18	.1884E+03	19	.1884E+03	20	.1884E+03
21	.1409E+03	22	.1409E+03	23	.1409E+03	24	.1409E+03
25	.1409E+03	26	.1409E+03	27	.1409E+03	28	.1409E+03
29	.1409E+03	30	.1409E+03	31	.9350E+02	32	.9350E+02
3 3	.9350E+02	34	.9350E+02	35	.9350E+02	36	.9350E+02
37	.9350E+02	38	.9350E+02	39	.9350E+02	40	.9350E+02
41	.4610E+02	42	.4610E+02	43	.4610E+02	44	.4610E+02
45	.4610E+02	46	.4610E+02	47	.4610E+02	48	.4610E+02
49	.4610E+02	50	.4610E+02	51	1300E+01	52	1300E+01
53	1300E+01	54	1300E+01	55	1300E+01	56	1300E+01
57	1300E+01	58	1300E+01	59	1300E+01	60	1300E+01

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SOLVE DISPLACEMENTS Version 1.1 02/01/85

LTHD muzzle brake thermal load - titanium

LOAD CASE 1

Node	Fx	Fy	Fz	Mx	My	Mz
1	3326E+05	1570E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
2	.5903E+04	2812E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
3	.7079E+04	2539E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
4	.7570E+04	1892E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
5	.1450E+05	9546E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
6	.4033E+04	2812E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
7	.2135E+04	6430E+03	.0000E+00	.0000E+00	.0000E+00	.0000E+00
8	6569E+05	1040E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
9	.1166E+05	.1843E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
10	.1398E+05	.2218E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
11	.1495E+05	.2366E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
12	.2863E+05	.4537E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
13	.7967E+04	.1261E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
14	.4218E+04	.6683E+03	.0000E+00	.0000E+00	.0000E+00	.0000E+00
15	6326E+05	2055E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
16	.1123E+05	.364BE+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
17	.1347E+05	.4375E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
18	.1440E+05	.467BE+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
19	.2757E+05	.B959E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
20	.7671E+04	.2492E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
21	.4061E+04	.1320E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
22	5926E+05	3020E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
23	.1052E+05	.5359E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
24	.1262E+05	.6425E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
25	.1349E+05	.6878E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
26	.258TE+05	.1316E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
27	.7187E+04	.3662E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
28	.3805E+04	.1939E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
29	5381E+05	3909E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
30	.9550E+04	.6938E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
31	.1145E+05	.8322E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
32	.1225E+05	.8899E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
33	.2345E+05	.1704E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
34	.6525E+04	.4741E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
35	.3455E+04	.2510E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00

SOLVE DISFLACEMENTS

Version 1.1 02/01/85

LTHD muzzle brake thermal load - titanium

LOAD CASE 1

AFFLIED LOAD VECTOR

Node	F×	Fy	Fz	Мж	My	Mz
36	4703E+05	4703E+05	.0000E+00	. 0000E+00	.0000E+00	.0000E+00
37	.8347E+04	.8347E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
38	.1001E+05	.1001E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
39	1071E+05	.1070E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
40	.2050E+05	.2050E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
41	.5703E+04	.5704E+04	.Q000E+Q0	.0000E+00	.0000E+00	.0000E+00
42	.3020E+04	.3020E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
43	3909E+05	5381E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
44	.6935E+04	.9553E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
45	.8328E+04	.1145E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
46	.8898E+04	.1225E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
47	.1704E+05	.2346E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
48	.4742E+04	.6525E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
49	.2510E+04	.3455E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
50	3020E+05	5926E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
51	.5360E+04	.1052E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
52	.6424E+04	.1262E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
53	.6876E+04	.1349E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
54	.1316E+05	.2583E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
55	.3661E+04	.7187E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
56	.1939E+04	.3805E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
57	2055E+05	6326E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
58	.3652E+04	.1123E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
59	.4372E+04	.1347E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
60	.4678E+04	.1440E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
61	.8959E+04	.2757E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
62	.2493E+04	.7671E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
63	.1320E+04	.4061E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
64	1040E+05	6569E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
65	.1847E+04	.1166E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
66	.2218E+04	.1398E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
67	.2363E+04	.1495E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
68	.4537E+04	.2863E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
69	.1262E+04	.7967E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
70	.6680E+03	.4218E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
71	1570E+05	3326E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
72	2812E+05	.5902E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
73	2539E+05	.7079E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
74	1891E+05	.7570E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
75	9546E+04	.1450E+05	.0000E+00	.0000E+00	,0000E+00	.0000E+00

SOLVE DISFLACEMENTS

Version 1.1 02/01/85

LTHD muzzle brake thermal load - titanium

LOAD CASE 1

Node	F×	Fy	F≈	М×	My	Mz
76	2812E+04	.4033E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
77	6430E+03	.2135E+04	.0000E+00	.00000E+00	.0000E+00	. 00000E+00

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SOLVE DISPLACEMENTS

Version 1.1 02/01/85

LTHD muzzle brake thermal load - titanium

LOAD CASE 1

DISPLACEMENTS

	Tra		ons	/		tatio	
Node	X	Υ	Z	1	X	Y	Z
1	.5773E-02	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	.6525E-02	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
3	.7261E-02	.0000E+00	.0000E+00	1	.0000E+00	.0000E+00	.0000E+00
4	.7784E-02	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
5	.8111E-02	.0000E+00	.0000E+00		.0000E+00	.0000E+00	.00000E+00
6	.8174E-02	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
7	.8106E-02	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.00000E+00
8	.5702E-02	.9031E-03	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
9	.6445E-02	.1021E-02	.0000E+00	1	.0000E+00	.0000E+00	.0000E+00
10	.7171E-02	.1136E-02	.0000E+00	1	.0000E+00	.0000E+00	.0000E+00
11	.7689E-02	.1218E-02	.00000E+00	/	.0000E+00	.0000E+00	.0000E+00
12	.8012E-02	.1269E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
13	.8074E-02	.1279E-02	.00000E+00	/	.0000E+00	.0000E+00	.0000E+00
14	.8006E-02	.1268E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
15	.5490E-02	.1784E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
16	.6206E-02	.2016E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
17	.6905E-02	.2244E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
18	.7403E-02	.2406E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
19	.7714E-02	.2507E-02	.00000E+00		.0000E+00	.0000E+00	.0000E+00
20	.7774E-02	.2526E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
21	.7709E-02	.2505E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
22	.5144E-02	.2621E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
23	.5814E-02	.2962E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
24	.6469E-02	.3296E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
25	.6936E-02	.3534E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
26	.7227E-02	.3683E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
27	.7283E-02	.3711E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
28	.7222E-02	.3680E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
29	.4670E-02	.3393E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
30	.5279E-02	.3835E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
31	.5874E-02	.4268E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
32	.629BE-02	.4576E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
33	.6562E-02	.4768E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
34	.6613E-02	.4805E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
35	.6557E-02	.4764E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
36	.4082E-02	.4082E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
37	.4614E-02	.4614E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
38	.5134E-02	.5134E-02	.0000E+00		.0000E+00	.0000E+00	• ΦΦΦΦΕ+ΦΦ
39	.5504E-02	.5504E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
40	.5736E-02	.5736E-02	.OOOOE+OO	/	.00000E+00	.0000E+00	.00000 E +00

```
1-12-1987
                                                               6
        Copyright (c) 1984
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        SOLVE DISPLACEMENTS
                                 Version 1.1 02/01/85
LTHD muzzle brake thermal load - titanium
                    LOAD
                              CASE
     Translations
                                           Rotations
.5780E-02
            .5780E-01
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .5731E-02
                       .0000E+00 /
                                               .0000E+00
            .5731E-02
                                    .0000E+00
                                                          .0000E+00
 .3393E-02
            .4670E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .3835E-02
            .5279E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
            .5874E-02
 .426BE-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .4576E-02
            .6298E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .4768E-02
            .6562E-02
                                               .0000E+00
                       .0000E+00 /
                                    .0000E+00
                                                          .0000E+00
 .4805E-02
            .6613E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .4764E-02
            .6557E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .2621E-02
            .5144E-02
                       .0000E+00 /
                                    .00000E+00
                                               .0000E+00
                                                          .0000E+00
 .2962E-02
            .5B14E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .3296E-02
            .6469E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
            .6936E-02
 .3534E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .3682E-02
            .7227E-02
                                               .0000E+00
                                                          .0000E+00
                       .0000E+00 /
                                    .0000E+00
 .3711E-02
            .7283E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
            .7222E-02
 .3680E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .1784E-02
            .5490E-02
                                               .0000E+00
                       .0000E+00 /
                                    .0000E+00
                                                          .0000E+00
 .2016E-02
            .6206E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .2244E-02
            .6905E-02
                                               .0000E+00
                       .0000E+00 /
                                    .0000E+00
                                                          .0000E+00
 .2406E-02
            .7403E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .2507E-02
            .7714E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .2526E-02
            .7774E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
            .7709E-02
                       .0000E+00 /
                                               .0000E+00
                                                          .0000E+00
 .2505E-02
                                    .0000E+00
 .9031E-03
            .5702E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .1021E-02
            .6445E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .1136E-02
            .7171E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .1218E-02
            .7689E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .00000E+00
 .1269E-02
            .8012E-02
                       .0000E+00 /
                                    .0000E+00
                                               .0000E+00
                                                          .0000E+00
 .1279E-02
            .B074E-02
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 .1268E-02
            .8006E-02
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 .0000E+00
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            .7260E-02
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                                                       PAGE
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      Copyright (c) 1984
                            Celestial Software Inc. =
     SOLVE FLATE LOADS/STRESSES
                                  Version 1.1
```

LTHD muzzle brake thermal load - titanium

Node

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FLATE LOADS AND/OR STRESSES

Loads	Node	Fх		Fy		Fz	M>:		My		M.E
Stress	Surf	Sioma		51 gma		Tau XY	Siama	1	2 تا تا ساح	=	Arigle.
Stress		Shear	ΧZ	Shear	ΥZ						1
							4				
		1007	- 00		_	LATE NO.	1***		6,6,6,6,5		
Loads	1	.1826		.4228		.0000E+00			.0000E	-	.0000E+00.
Loads		6539I		.4082		.0000E+00	.0000E		.0000E		. ŪḍḍḍḤ ⊱ ṭḍḍ
Loads		7409				.0000E+00	.0000E		.0000E		. ὑἀοὰ [. + ὑὰ.
Loads	8			4176		.0000E+00	.0000E		.0000E		. 00000E+00
Stress	LIFLI	85618	****			.1578E+04		. + Q S	2091E	+05	4.5
	_		.			LATE NO.	2***				
Loads		6614		. 4176		.0000E+00	.0000E		. 0000E		.Open⊕E+00
Loads		12846		.3929		.0000E+00	. 0000E	•	. GÓGÓE		.0000E+00
Loads	16			4 084		.0000E+00	.0000E		.0000E		.0.00E+00
Loads	15			4021		.0000E+00	. 0000E		.0000E		. 00000E+00
Stress	MFM	8562	E + O 3	=		.1578E+04		:+03	⊋051E	(+ 05	4.5
						LATE NO.	3***				
Loads		1306				.0000E+00			. 0000E		. (\documents) (\d
Loads		1883		.3680		.0000E+00	. 0000E		.0000E		. OriobijE+bij
Loads	23			3934		.0000E+00	. 0000E		. 0000E		. 00000E+00
Loads	22			3767		.0000E+00	. 0000E	+00	. QOQOE	+ 00	. (ÞÞÐÐE+00)
Stress	MEM	8561	E+03			.1579E+04	7319E	1+03	2091E	+05	4.5
						LATE NO.	4***				
Loads	22	1919	E+04	. 3767		.0000E+00	.0000E	+00	. 0000E	+ (40)	.¢⊙àò6E+00:
Loads	23	2436	E+04	.3340	E+04	.0000E+00	. 0000E	+ 00	. 0000E	+00	.00000E+00
Loads	30	. 1 870i	E+04	36B7	E+04	.0000E+00	.0000E	+ 00	.OOOOE	+ 00	. OOCOE+OC
Loads	29	. 2485	E+04	3420	E+04	.0000E+00	. QOQOE	+ 00	. 0000E	(+()()	.0000E+00
Stress	MEM	8561	E+03	2075	E+05	.1578E+04	7319E	+ 03	2091E	+65%	4.5
				****	UAD F	LATE NO.	5+++				
Loads	29	2485	E+04	.3420	E+04	.0000E+00	.0000E	+ 00	.0000E	+00	.0000E+00
Loads	30	2928	E+04	.2918	E+04	.0000E+00	.0000E	+ 00	. 0000E	+00	.00000E+00
Loads	37	. 2424	E+04	3349	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	36	. 29898	E+04	2989	E+04	.0000E+00	.0000E	+00	.0000E	+00	,00000E+00
Stress	MEM	85618	E+03	2079	E+05	.1578E+04	7319E	+03	2091E	+05	4.5
				****	UAD F	LATE NO.	6***				
Loads	36	2989	E+04	. 2989	E+04	.0000E+00	. 0000E	+00	.0000E	+00	.00000E+00
Loads	37	33498	E+04	. 2424	E+04	.0000E+00	.0000E	+00	.0000E	+00	.00000E+00
Loads	44	.2918	E+04	2928	E+04	.0000E+00	.0000E	+QQ	.0000E	+00	.00000E+00
Loads	43	.34200	E+04	2485	E+04	.0000E+00	.0000E	(+00	.0000E	+00	.00000 E +00
Stress	MEM	85626	E+03	2079	E+05	.1579E+04	7319E	+03	2091E	+05	4.5
_						LATE NO.	7***				
Loads	43	3420	E+04	. 2485		.0000E+00	.0000E	+00	.0000E	+ 00	.0000E+00
Loads		3687		.1870		.0000E+00	.0000E		.0000E	-	.0000E+00
	• •		• •	- · · ·	• •	3					

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LTHD muzzle brake thermal load - titanium

```
Load Case 1:
                             Fy
                                         Fz
                                                                              Mic
Loads Node
                 F :
Stress Surf
              Sigma
                          Sigma
                                        Tau XY
                                                   Sigma
                                                               Sigma
                                                                             Angle
              Shear XZ
                          Shear YZ
          51
              .3340E+04 -.2436E+04
                                                   .ÕÕÕĢE+ÕÕ
                                                               . Or an the E + thus
                                      ,0000E+00
Loade
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         €,3
              .3767E+04 -.1919E+04
                                      . OOOOOE +OO
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Loade
                                                                           .OrdotE+Od
        MEM -.8561E+03 -.2079E+05
                                       .1579E+04 -.7019E+03 -.2091E+05
Stress
                                                                               4.5
                           ***DUAD FLATE NO.
                                                 B***
                                                               .0000E+00
          50 -. 3767E+04
                          .1919E+04
                                      .00000E+00
                                                   .Q0000E+00
                                                                           .OgG⊝E+++
Loads
         51 -.3934E+04
Loads
                          .1270E+04
                                      .0000E+00
                                                   .QQQQE+QQ

    • O⊕⊕⊕E + ⊕⊕

                                                                           .0000E+00
         58
Loads
             .3680E+04 -.1883E+04
                                      .00000E+00
                                                   .00006E+00
                                                               .00000E+00
                                                                           .0000E+00
Loads
         57
              .4021E+04 -.1306E+04
                                      .00000E+00
                                                   .QQQQE+QQ
                                                               .00000E+000
                                                                           . 00000£+00
        MEM -.8561E+03 -.2079E+05
Stress
                                      .1578E+04 -.7319E+03 -.2091E+05
                                                                               4.5
                                                 9***
                           ***DUAD FLATE NO.
          57 -.4021E+04
                          .1306E+04
                                                   .00000E+00
Loads
                                      .00000E+00
                                                               . 60000E+06
                                                                           .0000E+00
          58 -.4064E+04
Loads
                          .6394E+03
                                      .0000E+00
                                                   .OOOOE+00
                                                               . ֆերիինը + Հի հ
                                                                           .0000E+00
              .3929E+04 -.1284E+04
Loads
         65
                                      .0000E+00
                                                   .0000E+00
                                                               .0000E+00
                                                                           .00000E+00
Loads
         04
              .4176E+04 -.6614E+03
                                      .0000E+00
                                                   . 00000E+00
                                                               . ΟρφοΕ+όσο
                                                                           . ΟὐύψΕ+όΦ
Stress
        MEM -.8561E+03 -.2079E+05
                                      .15788+04 -.7319E+03 -.2091E+05
                                                                               4.5
                           ***DUAD FLATE NO.
                                               10+++
         64 -.4176E+04
                                                  .00000E+00
                                                                           .0000E+00
Loads
                          .6614E+⊕3
                                      .00000E+00
                                                               .ÒÇŌÇĒ+ÒÓ
         65 -.4134E+04 -.7401E+01
                                      .0000E+00
                                                  .00000E+00
                                                              . OCOCE+OC
                                                                           .0000E+00
Loads
          7.
              .4082E+04 -.6540E+03
Loads
                                      .0000E+00
                                                  .00000E+00
                                                               .0000E+00
                                                                           .¢0000E+00
                         .B658E-09
                                      .0000E+00
                                                  .00000E+00
Loads
         71
              .4228E+04
                                                                           .0000E+00
                                                               , 00000E+00
        MEM -.8561E+03 -.2079E+05
                                      .1579E+04 -.7319E+03 -.2091E+05
Stress
                                                                               4.5
                           ***DUAD FLATE NO. 11***
              .6579E+03
                          .3004E+04
                                      .0000E+00
                                                   .00000E+00
                                                               .00000E+00
                                                                           .00000E+00
Loads
Loads
            -.1113E+04
                          .D828E+04
                                      .00000E+00
                                                   .00000E+00
                                                               .00000E+00
                                                                           .00000E+00
          10 -.6568E+03 -.2967E+04
                                                               .00000E+00
                                                                           .00000E+00
Loads
                                      .00000E+00
                                                   .00000E+00
             .1116E+04 -.2865E+04
                                      .00000E+00
                                                                           .00000E+00
Loads
                                                  .¢¢¢òòE+¢o
                                                              .OOOOE+OO
Stress
        MEM -.1776E+04 -.1168E+05
                                      .7849E+03 -.1714E+04 -.1175E+05
                                                                               4.5
                           ***DUAD PLATE NO. 12++*
Loads
             .1759E+03
                          .3070E+04
                                      .0000E+00
                                                  .00000E+00
                                                               .0000E+00
                                                                           .0000E+00
          10 -.1542E+04
                          .2619E+04
                                      .0000E+00
                                                              .00000E+00
Loads
                                                  .0000E+00
                                                                           .OOOOE+OO
Lo≥ds
          17 -.1846E+03 -.3033E+04
                                      .0000E+00
                                                  .0000E+00
                                                               .00000E+00
                                                                           .0000E+00
Loads
          16
             .1551E+04 -.2656E+04
                                      .00000E+00
                                                  .0000E+00
                                                              .00000E+00
                                                                           .00000E+00
Stress
        MEM -.1776E+04 -.1168E+05
                                      .7849E+03 -.1714E+04 -.1175E+05
                                                                               4.5
                           ***DUAD FLATE NO. 13***
                                                   .00000E+00
          16 -.3065E+03
                                                                           , OOOOE+OO
Loads
                          .3060E+04
                                      .0000E+00
                                                               .0000E+00
          17 -.1932E+04
                                      .0000E+00
                                                   .0000E+00
                                                                           .00000E+00
Loads
                          .2345E+04
                                                               .0000E+00
         24
Loads
              .2921E+03 -.3025E+04
                                      .0000E+00
                                                   .0000E+00
                                                               .00000E+00
                                                                           .0000E+00
          27
Loads
              .1947E+04 -.2380E+04
                                      .0000E+00
                                                  .00000E+00
                                                               .00000E+00
                                                                           .0000E+00
```

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.00000E+00

4.5

.00000**E**+00

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DUAD PLATE NO. 14

.7846E+03 -.1714E+04 -.1175E+05

.0000E+00 .0000E+00

MEM -.1776E+04 -.1168E+05

23 -.7814E+03

Stress

Loads

.2974E+04

```
Load Case
                                                                                   21
Loads
       Node
                  Fs.
                              Fv
                                           Fz
                                                       Mile
                                                                                Mil
                                                                   MV
Stress Surf
              Sigma
                           Sigma
                                         Tau XY
                                                    510ma
                                                                Sigma
                                                                               Andle
Stress
               Shear X7
                           Shear Y7
             -.2275E+04
Loads
          24
                           .2014E+04
                                       .000008+00
                                                    . QQQQQE+++Q
                                                                , ((()()()()(E + ()()
Loads
          31
               .7617E+05 -.2942E+04
                                       .00000E+00
                                                    , 00000E+00
                                                                . OOQQQE + Co
                                                                             . ( - - - - - ) E → ( - - )
Loads
          30
               .2295E+04 -.2046E+04
                                                    .00000E+00
                                                                .00000E+00
                                        .000005+00
                                                                             . ĢĢĢĢE+ĢO
Stress
         MEM -.1776E+04 -.1168E+05
                                        .7845E+03 -.1714E+04 -.1175E+05
                                                                                 4.5
                            ***CUAD FLATE NO.
                                                 15***
          30 -.1237E+04
Loads
                           .DB15E+04
                                       .00000E+00
                                                    , 00000E+00
                                                                .0000E+00
                                                                             . 0000E+00
          31
             -.2563E+04
                           .1633E+04
                                                    .0000E+00
                                                                .0000E+00
Loads
                                        . OOOOOE+OO
                                                                             . CHACHE + OH
Loads
          38
               .1212E+04 -.2786E+04
                                       . 00000E+00
                                                    . 00000E+00
                                                                .0000E+00
                                                                             . ObboroE + Opt
          37
               .2587E+04 -.1662E+04
                                                    .OOOOE+OO
                                                                .00006E≠00
Loads
                                        .00000E+00
                                                                             .սՀանֆ[+Ծֆ
         MEM -.1776E+04 -.1168E+05
                                        .7846E+03 -.1714E+04 -.1175E+05
Stress
                                                                                 4.5
                            ***DUAD FLATE NO.
                                                 16***
Loads
          37 -.1662E+04
                           .2587E+04
                                       .00000E+00
                                                    .00000E+00
                                                                . 00000E+00
                                                                             .nujid€+oj
Loads
          7.8
             -.2787E+04
                           .1213E+04
                                       .00000E+00
                                                    .0000E+00
                                                                . 00000E+00
                                                                             .uniquE+Ou
                                                                             . 00000E+00
Loads
              .1634E+04 -.2563E+04
                                       . 00000E+00
                                                    .00000E+00
                                                                .00000E+00
              .2815E+04 -.1237E+04
          44
                                        .00000E+00
                                                    .0000E+00
                                                                .00000E+00
                                                                             . ((()()(E+))()
Loads
Stress
         MEM -.1776E+04 -.1168E+05
                                        .7845E+03 -.1714E+04 -.1175E+05
                                                                                 4.5
                            ***DUAD FLATE NO. 17***
             -.2046E+04
                           .2295E+04
                                                                             . ODDOE+00
Loads
                                       .0000E+00
                                                    .00000E+00
                                                                .00000E+00
          45
             -.2942E+04
                           .7619E+03
                                                    .0000E+00
                                                                .00000E+00
                                                                             ,0000E+00
Loads
                                        .0000E+00
          50
               .2015E+04 -.2276E+04
Loads
                                        . 00000E+00
                                                    .0000E+00
                                                                .00000E+00
                                                                             . @⊕⊕⊕E+⊕⊕
               .2974E+04 -.7812E+03
                                                                             , ĢĢĢĢĒ+ĢĀ
Loads
          51
                                        .0000E+00
                                                    .00000E+00
                                                                .00000E+00
         MEM -.1776E+04
                         -.116BE+05
                                       .7844E+03 -.1714E+04 -.1175E+05
                                                                                 4.5
Stress
                            ***QUAD PLATE NO.
                                                 18***
                           .1946E+04
          51 -.2380E+04
                                       .0000E+00
                                                                .0000E+00
                                                                             .0000E+00
                                                    .0000E+00
Loads
             -.3025E+04
          52
                           .2923E+03
                                        .0000E+00
                                                    .0000E+00
                                                                .0000E+00
Loads
                                                                             , QQQQE+QQ
          59
               .2346E+04
                          -.1932E+04
Loads
                                       .0000E+00
                                                    .0000E+00
                                                                .0000E+00
                                                                             .0000E+00
          58
               .3059E+04
                          -.3064E+03
                                                    .0000E+00
                                                                .0000E+00
Loads
                                        .0000E+00
                                                                             .0000E+00
Stress
         MEM -.1776E+04
                         -.1168E+05
                                       .7849E+03 -.1714E+04 -.1175E+05
                                                                                 4.5
                            ***OUAD FLATE NO.
                                                 19***
                           .1550E+04
          58 -.2655E+04
                                       .0000E+00
                                                    .0000E+00
                                                                .0000E+00
                                                                             .0000E+00
Loads
          59 -.3033E+04 -.1847E+03
Loads
                                       .00000E+00
                                                    .00000E+00
                                                                .00000E+00
                                                                             .00000E+00
              .2619E+04 -.1542E+04
Loads
                                       .00000E+00
                                                    .0000E+00
                                                                .0000E+00
                                                                             .00000E+00
          66
               .3070E+04
                           .1759E+03
                                       .00000E+00
                                                    .0000E+00
                                                                .00000E+00
                                                                             .0000E+00
Loads
          65
         MEM -.1776E+04 -.1168E+05
                                       .7847E+03 -.1714E+04 -.1175E+05
                                                                                 4.5
Stress
                            ***QUAD PLATE NO.
                                                 20***
          65 -.2865E+04
                                                                             .0000E+00
Loads
                           .1116E+04
                                       .0000E+00
                                                    .0000E+00
                                                                .0000E+00
             -.2967E+04 -.6569E+03
                                       .0000E+00
                                                    .0000E+00
                                                                .0000E+00
                                                                             .0000E+00
Loads
Loads
          7.
               .2828E+04 -.1113E+04
                                       .0000E+00
                                                    .0000E+00
                                                                .0000E+00
                                                                             .0000E+00
                           .6540E+03
               .3005E+04
Loads
          72
                                       .0000E+00
                                                    .0000E+00
                                                                .0000E+00
                                                                             .0000E+00
```

4.5

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.7845E+03 -.1714E+04 -.1175E+05

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MEM -.1776E+04 -.1168E+05

Stress

LTHD muzzle brake thermal load - titanium

```
Load Cast
                                                                                 2.
                                        Fz
       Node
                 F::
                             FV
Loade
                                                                MV
                                                                            11-
Stress
              Sioma
                     X
                          Sigma
                                       Tau XY
                                                  Sigma
                                                             Sigma
                                                                           Angle
              Shear X7
                          Stream YZ
                           ***OUAD PLATE NO.
              .1117E+04
                          .6274E+03
                                     .00000E+00
                                                 .0000E+00
Loads
                                                             . ŎŎŎŎŎĔ + ŎĞ
                                                                         . 00000E+00
          4 -.1202E+04
                         .5010E+03
                                      .00000E+00
                                                  .00000E+00
                                                             .00000E+00
Loads
                                                                         .OOOOE+OU
         11 -.1109E+04 -.6828E+03
                                                  .0000E+00
                                                             .0000E+00
Loads
                                      .0000E+00
                                                                         . 00000E+00
Loads
         1 \cdots
             .1197E+04 -.4455E+03
                                      .00000E+00
                                                  .0000E+00
                                                             .QQQQE+00
                                                                         .0000E+00
Stress
        MEM -.2052E+04 -.2277E+04
                                      .1781E+02 -.2051E+04
                                                            -.2279E+04
                                                                             4.5
                           ***DUAD PLATE NO.
                                               22***
                                      .0000E+00
                                                 .0000E+00
         10 .1001E+04
                          .7939E+03
                                                             .00000E+00
                                                                         .0000E+00
Loads
                          .3069E+03
                                                  .00000E+00
                                                             .0000E+00
         11 -.1265E+04
Loads
                                      .0000E+00
                                                                         .0000E+00
         16 -.9881E+03 -.8479E+03
                                                  .0000E+00
                                                             .0000E+00
Loads
                                      .0000E+00
                                                                         .0000E+00
              .1252E+04 -.2529E+05
         17
                                      .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                         .0000E+00
Loads
        MEM -.2052E+04 -.227BE+04
                                      .1789E+02 -.2051E+04 -.2279E+04
Stress
                                                                             4.5
                           ***DUAD PLATE NO.
                                               23***
             .B646E+03
                          .9406E+03
Loads
         17
                                      .0000E+00
                                                             .0000E+00
                                                  .00000E+00
                                                                         .00000E+00
         18 -.1298E+04
Loads
                          .1052E+03
                                      .0000E+00
                                                  .0000E+00
                                                             .0000E+00
                                                                         .00000E+00
         25 -.8433E+03 -.9920E+03
                                                                         .0000E+00
Loads
                                      .0000E+00
                                                  .0000E+00
                                                             .00000E+00
                                                 .00000E+00
                                                             .0000E+00
                                                                         .0000E+00
Loads
          24
              .1277E+04 -.5378E+02
                                      .0000E+00
        MEM -.2052E+04 -.2277E+04
                                      .1787E+02 -.2051E+04 -.2279E+04
Strees
                                                                             4.5
                           ***DUAD FLATE NO.
                                               24***
                                     .0000E+00
                                                             .0000E+00
Loads
             .7068E+03
                         .1064E+04
                                                 .0000E+00
                                                                         .0000E+00
            -.1298E+04 -.9933E+02
                                                                         .0000E+00
Loads
                                      .0000E+00
                                                 .0000E+00
                                                             .00000E+00
                                      .0000E+00
                                                 .0000E+00
Loads
            -.6779E+03 -.111TE+04
                                                             .0000E+00
                                                                         .00000E+00
          31
             .1269E+04
                         .1465E+03
                                      .0000E+00
                                                 .0000E+00
Loads
                                                             .0000E+00
                                                                         .00000E+00
        MEM -.2052E+04 -.2277E+04
                                      .1786E+02 -.2051E+04
                                                            -.2279E+04
Stress
                                                                             4.5
                                               25***
                           ***DUAD FLATE NO.
              .5315E+03
                          .1162E+04
                                      .00000E+00
                                                 .0000E+00
                                                             .00000E+00
                                                                         .0000E+00
Loads
Loads
            -.1267E+04 -.3012E+03
                                      .0000E+00
                                                  .0000E+00
                                                             .0000E+00
                                                                         .0000E+00
                                      .0000E+00
Loads
         39 -.4956E+03 -.1204E+04
                                                  .00000E+00
                                                             .0000E+00
                                                                         .0000E+00
                                                             .0000E+00
Loads
         38
             .1231E+04
                         .3433E+03
                                      .0000E+00
                                                  .0000E+00
                                                                         .0000E+00
Stress
        MEM -.2052E+04 -.2277E+04
                                      .1769E+02 -.2051E+04 -.2279E+04
                                                                             4.5
                           ***DUAD PLATE NO.
                                               26***
             .3434E+03
                         .1231E+04
                                     .0000E+00
Loads
                                                 .0000E+00
                                                             .0000E+00
                                                                         .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                         .0000E+00
         39 -.1204E+04 -.4955E+03
                                      .0000E+00
Loads
                                                 .0000E+00
                                                             .00000E+00
                                                                         .00000E+00
            -.3011E+03 -.1267E+04
                                      .0000E+00
Loads
              .1162E+04
                                                 .0000E+00
                                                             .0000E+00
Loads
                          .5316E+03
                                      .0000E+00
                                                                         .0000E+00
                                                            -.2279E+04
        MEM -.2052E+04
                        -.2277E+04
                                      .1796E+02 -.2051E+04
                                                                             4.5
Stress
                           ***QUAD PLATE NO.
                                               27***
             .1466E+03
                          .1269E+04
                                      .0000E+00
                                                 .0000E+00
         45
                                                             .0000E+00
                                                                         .0000E+00
Loads
                                                  .0000E+00
                                                             .0000E+00
                                                                         .00000E+00
         46 -.1112E+04 -.6778E+03
                                      .0000E+00
Loads
         53 -.9937E+02 -.1298E+04
                                                  .0000E+00
                                      .0000E+00
                                                             .0000E+00
                                                                         .0000E+00
Loads
             .1065E+04
                         .7068E+03
                                      .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                         .0000E+00
```

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Loads

1	N 1	r	F	F-			メ3
Loade	Node	Fx Sigma X	Fv Frame	Fig.	M	My	Mz
Stress	Sur Y	Shear XZ	Sigma Y Shear YZ	Tau XY	Sigma 1	Sigma 2	Angle
Stress	MEM	2052E+04	2077E+04		2051E+04	2279E+04	4.5
			DUAD F		B		
Loads		5379E+02		. 0000E+00	. ΦΦΦΦΕ+ΦΦ	* ÓÓÓÓE+ÒÓ	. 00000E+00
Loads			8434E+03	. ŎŎŎŎŎ E →ŎŎ	.0000E+00	.0000E+00	. OOOOE+06
Loads	60		1298E+04	. 00000E+00	, 00000E+00	.0000E+00	. 00000E+00
Loads	59	.9405E+03	· - · · -	.QQQQE+QQ	.0000E+00	.0000E+00	. ΟφφόΕ+φό
Stress	MEM	2052E+04			2051E+04	2279E+04	4.4
			DUAD F		29		
Loads	5,9	2529E+03	.1252E+04	.0000E+00	.ĢÒÒÒÒE≁ÕÒ	.0000E+00	.0000E+00
Loads	60	8479E+03	986DE+03	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	67		1265E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	66	.7939E+03	.1001E+04	.00000E+00	.0000E+00	.0000E+00	.O000E+00
Stress	MEM	2052E+04	2278E+04	.178JE+02	2051E+04	2279E+04	4.5
			***DUAD F	LATE NO. 3	\$ () ***		
Loads	66	4457E+03	.1197E+04	.00000E+00	. 00000 E+ 00	.0000E+00	.00000E+00
Loads	67	6827E+03	1109E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	74	.5008E+03	1202E+04	.00000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	73	.6275E+03	.1113E+04	.00000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	2052E+04	2277E+04	.1785E+02	2051E+04	2279E+04	4.5
			DUAD F	LATE NO.	11		
Loads	4	.1202E+04	1596E+04	.00000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	5	-,9462E+03	1653E+04	. 00000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	12	1193E+04	.1485E+04	.0000E+00	.0000E+00	.0000E+00	.00000E+00
Loads	11	.9374E+03	.1764E+04	.0000E+00	.0000E+00	.0000E+00	.00000E+00
Stress	MEM	1701E+04	.6483E+04	648DE+03	.6534E+04	1752E+04	-85.5
			DUAD F	LATE NO. I	2		
Loads	1 1	.1437E+04	1388E+04	.0000E+00	.0000E+00	.0000E+00	.00000E+00
Loads	12	6759E+03	1781E+04	.0000E+00	.00000E+00	.0000E+00	.0000E+00
Loads	19	1411E+04	.1280E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	18	.6498E+03	.1889E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	1701E+04		6481E+03	.6534E+04	1752E+04	-85.5
			DUAD P		53		,
Loads	18	.1636E+04	1146E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads			1864E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	_	1593E+04		.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	25	.3464E+03		.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress		1701E+04		6480E+03		1752E+04	-85.5
	, , , , , , ,	TERMSENSON	***DUAD F		4***	**/ ==== .	55.5
Loads	25	.1795E+04		.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads		9250E+02		.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads		1737E+04		.0000E+00	.0000E+00	.0000E+00	.0000E+00
20002		* 1/S/ETU#	./OIIETUS	• OCCUPE TOO	* ************************************	• 00000E ±00	· OUTUE TOU

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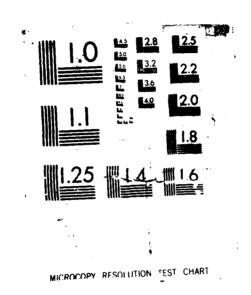
							del
Loads	Node	Fκ	F∨	Fz	M·:	My	Mz
Stress	Surf	Sigma X	Sigma Y	Tau XY	Sigma 1	Sigma 2	Angl <i>e</i>
Stress		Shear XI	Shear YZ				
Stress	MEM	1701E+04	.6483E+04	6482E+03	.6534E+0	41752E+04	-85.5
			DUAD I	PLATE NO. I	S5		
Loads	32	.1910E+04	5845E+03	.0000E+00	.0000E+0	.0000E+00	.0000E+00
Loads	33	.2061E+03	1893E+04	.0000E+00	.0000E+0	.0000E+00	.0000E+00
Loads	4 🔾	1838E+04	.4999E+03	.0000E+00	.0000E+0	.0000E+00	.0000E+00
Loads	39	2783E+00	.1978E+04	.0000E+00	.0000E+0	.0000E+00	.0000E+00
Stress	MEM	1701E+04	.6483E+04	6480E+03	.6534E+0	41752E+04	-85.5
			DUAD F	LATE NO. 3	6		
Loads	26	.1978E+04	2784E+03	.0000E+00	.0000E+0	.0000E+00	.0000E+00
Loads	40	.4998E+03	1838E+04	.0000E+00	.0000E+00	.0000E+00	.00000E+00
Loads	47	1893E+04	.2061E+03	.0000E+00	.0000E+0	00000E+00	.0000E+00
Loads	46	5845E+03	.1910E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	1701E+04	.6483E+04	6482E+03	.6534E+0	41752E+04	-85.5
			DUAD F	PLATE NO. 3	7		
Loads	46	.1997E+04	.3439E+02	.0000E+00	.0000E+0	.0000E+00	.0000E+00
Loads	47	.7812E+03	1737E+04	.0000E+00	.0000E+00	0000E+00	.0000E+00
Loads	54	1902E+04	9 263E+02	.0000E+00	.0000E+0	.00000E+00	.0000E+00
Loads	53	8763E+03	.1795E+04	.0000E+00	.0000E+00	00000E+00	.0000E+00
Stress	MEM	1701E+04	.6483E+04	6482E+03	.6534E+0	41752E+04	-85.5
			DUAD F	LATE NO. 3	8		
Loads	53	.1968E+04	.3463E+03	.0000E+00	.0000E+0	.0000E+00	.0000E+00
Loads	54	.1043E+04	1593E+04	.0000E+00	.0000E+00	0000E+00	.0000E+00
Loads	61	1864E+04	3890E+03	.0000E+00	.0000E+0	.00000E+00	.0000E+00
Loads	60	1146E+04	.1636E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	1701E+04	.6483E+04	6480E+03	.6534E+0	41752E+04	-85.5
			***DUAD R	PLATE NO. 3	59 * **		
Loads	60	.1889E+04	.6499E+03	.0000E+00	.0000E+0	.0000E+00	.0000E+00
Loads	61	.1280E+04	1411E+04	.0000E+00	.0000E+00	00+30000. C	.0000E+00
Loads	68	1780E+04	67 60E+03	.0000E+00	.0000E+0	00+30000. C	.0000E+00
Loads	67	1388E+04	.1437E+04	.0000E+00	.0000E+00	00+ 3 0000 E +00	.0000E+00
Stress	MEM	1701E+04	.6483E+04	6482E+03	.6534E+0	11752E+04	-85.5
			DUAD i	LATE NO. 4)O		
Loads	67	.1764E+04	.9374E+03	.0000E+00	.0000E+0	0000E+00	.0000E+00
Loads	68	.1485E+04	1193E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	75	1653E+04	94 62E+03	.0000E+00	.0000E+0	0000E+00	.0000E+00
Loads	74	1596E+04	.1202E+04	.0000E+00	.0000E+00	00+30000. C	.0000E+00
Stress	MEM	1701E+04	.6483E+04	6481E+03	.6534E+0	41752E+04	-85.5
			DUAD !	PLATE NO. 4	11		
Loads	5	.9462E+03	2568E+04	.0000E+00	.0000E+0	.0000E+00	.0000E+00
Loads	6	5418E+03	2572E+04	.0000E+00	.0000E+00	.0000E+00	.00000E+00

1 1. FA3 ==

Loads 13 -.9373E+03 .2456E+04 .0000E+00 .0000E+00 .0000E+00 .0000E+00

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LIGHTWEIGHT TOWED HOWITZER DEMONSTRATOR PHASE 1 AND PARTIAL PHASE 2 VOLUM (U) FMC CORP MINNEAPOLIS MINN NORTHERN ORDNANCE DIV R RATHE ET AL APR 87 FMC-E-3041-VOL-D1-PT-1 DAAA21-86-C-0047 F/G 19/6 /ND-R183 987 3/3 UNCLASSIFIED NL



Loads

											U, D
Loads	Node	F×		Fy		Fz	Мж		My		Mz
Stress	Surf	Sigma	X	Sigma	Y	Tau XY	Sigma	1	Sigma	2	Angle
Stress		Shear	ΧZ	Shear	YZ						-
Stress	MEM	10508	E+04	.1027	E+05	8965E+03	.1034E	+05	11218	+04	-85.5
				Q	UAD I	PLATE NO. 4	2				
Loads	12	.1336	E+04	2388	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	13	13278	E+03	2625	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	20	1310	E+04	. 2279	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	19	.10658	E+03	. 2734	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	1050	E+04	.1027	E+05	8966E+03	.1034E	+05	1121E	+04	-85.5
				***Di	UAD I	PLATE NO. 4	***				
Loads	19	. 1693	E+04	2149	E+04	.0000E+00	.0000E	+00	.0000E	QQ+	.0000E+00
Loads	20	. 27978			E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	27	16508	E+04	. 2046	E+04	.0000E+00	.0000E	+00	. 0000E	+00	.0000E+00
Loads	26	3227	E+03	. 2717	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	10508	E+04	.1027	E+05	8967E+03	.1034E	+05	1121E	+04	-85.5
				****	UAD I	PLATE NO. 4	14 ***				
Loads	26	. 20098	E+04	1858	E+04	.0000E+00	.0000E	+00	.0000E	00+3	.0000E+00
Loads	27	. 6849			E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	34	1950	E+04	.1762	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	33	7436	E+03	. 2633	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	10508	E+04	.1027	E+05	8966E+03	.1034E	+05	1121E	+04	-85.5
				****	UAD I	PLATE NO. 4	***				
Loads	33	.2274	E+04	1521	E+04	.0000E+00	.0000E	+ 00	.0000E	400	.0000E+00
Loads	34	.1074	E+04	2399	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	41	22028	E+04	.1435	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	40	1147	E+04	. 2485	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	1050	E+04	.1027	E+05	8969E+03	.1034E	+05	1121E	+04	-85.5
				Q	UAD I	PLATE NO. 4	16				
Loads	40	. 2485	E+04	1147	E+04	.0000E+00	.0000E	+00	.0000E	00+	.0000E+00
Loads	41	.14356	E+Q4	2201	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	48	2399	E+04	.1073	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	47	15218	E+04	. 2275	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	10508	E+04	. 1027	E+05	8965E+03	.1034E	+05	1121E	+04	-85.5
				0	UAD I	PLATE NO. 4	7				
Loads	47	. 26336	E+04	7437	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	48	.1762	E+04	1950	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	55	25376	E+04	. 6850	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	54	18588	E+04	. 2009	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	1050E	E+04	. 1027	E+05	8966E+03	.1034E		1121E	+04	-85.5
							8***				
Loads	54	. 27178	E+04	3226	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	55	. 2045	E+04	1650	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00

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62 -.2613E+04 .2794E+03 .0000E+00 .0000E+00 .0000E+00 .0000E+00

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l pad	Case	1:

Loads	Node	Fx	.,	Fy		_ Fz	Мж		My	_	Mz
Stress	Surt	Sigma	X	Sigma		Tau XY	Sigma	1	Sigma	2	Angle
Stress		Shear	X Z	Shear	ΥZ						
Stress	MEM	1050	F+04	- 1027	E+05	8969E+03	. 1034F	+05	1121E	+04	-85.5
							19***				00.0
Loads	61	. 27351	E+04	.1063	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	62	. 227Bi	E+04	1310	E+04	.0000E+00	.0000E	+00	.0000E		.0000E+00
Loads	69	2625	E+04	1327	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	68	23888	E+04	.1336	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	1050	E+04	.1027	E+05	8965E+03	.1034E	+05	1121E	+04	-85.5
				***DI	JAD F	PLATE NO. 5	50 ** *				
Loads	68	. 26841	E+04	.53291	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	69	. 2455	E+04	9374	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	76	2572	E+04	5416	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	75	2567	E+04	. 9462	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	1050	E+04	. 1027	E+05	~.8966E+03	.1034E	+05	1121E	+04	-85.5
				****	JAD R	PLATE NO. 5	51***				
Loads	6	.5418	E+03	3470	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	7	.3142	E-09	34126	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	14	5338	E+Q3	. 33701	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	13	80249	E+01	.3513	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	2646	E+03	. 1377	E+05	1112E+04	.1386E	+05	3521E	+03	-85.5
				DI	JAD F	PLATE NO. 5	52				
Loads	13	.1078	E+04	3344	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	14	.5338	E+03	3370	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	21	1054	E+04	. 3244	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	20	55778	E+03	.34691	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	2647	E+03	. 1377	E+05	1112E+04	.1386E	+05	3522E	+03	-85.5
				***D(JAD F	PLATE NO. 5	***				
Loads	20	. 1588	E+04	3134	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	21	.10546	E+04	3244	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	28	1549	E+04	.3039	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	27	1093	E+04	.3339	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	2647	E+03	. 1377	E+05	1111E+04	.1386E	+05	3521E	+03	-85.5
				***@l	JAD F	PLATE NO. 5	4 ** *				
Loads	27	. 2059	E+04	2847	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	28	. 1549	E+04	30390	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	35	2005	E+04	. 2760	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	34	1602	E+04	.31278	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	2647	E+03	. 1377	E+05	1111E+04	.1386E	+05	3522E	+03	-85.5
				DI	AD F	PLATE NO. 5	55				
Loads	34	. 2478	E+04	2490	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	35	. 2005	E+04	27608	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	42	+.2413	E+04	. 2413	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00

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Version 1.1 02/01/85

```
Load Case
Loads
     Node
                Fx
                            Fy
                                        Fz
                                                   М×
                                                                          Mz
Stress Surf
                    X
                         Sigma
                                      Tau XY
             Sigma
                                                Sigma
                                                            Sigma
                                                                         Angle
Stress
             Shear XZ
                         Shear YZ
       MEM -.2647E+03
                         .1377E+05 -.1111E+04
Stress
                                                .1386E+05 -.3521E+03
                                                                         -85.5
                          ***QUAD PLATE NO. 56***
         41
             .2837E+04 -.2071E+04
                                                .0000E+00
                                                            .0000E+00
Loads
                                     .0000E+00
                                                                       .0000E+00
         42
Loads
             .2413E+04 -.2413E+04
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
         49 -.2760E+04
                         .2005E+04
                                                .0000E+00
                                                            .0000E+00
Loads
                                     .0000E+00
                                                                       .0000E+00
                                     .0000E+00
                                                            .0000E+00
Loads
         48 -. 2490E+04
                         .2478E+04
                                                .0000E+00
                                                                       .0000E+00
        MEM -. 2646E+03
Stress
                         .1377E+05 -.1111E+04
                                                .1386E+05 -.3520E+03
                                                                         -85.5
                                              57***
                          ***OUAD FLATE NO.
                                     .0000E+00
                                                .0000E+00
Loads
             .3126E+04 -.1602E+04
                                                            .0000E+00
                                                                       .0000E+00
            .2760E+04 -.2005E+04
                                                           .0000E+00
Loads
                                     .0000E+00
                                                .0000E+00
                                                                       .0000E+00
                                                                       .0000E+00
Loads
         56 -.3040E+04
                        .1549E+04
                                                .0000E+00
                                                           .0000E+00
                                     .0000E+00
                                                           .0000E+00
         55 -.2846E+04
                         .2058E+04
                                    .0000E+00
                                                                       .0000E+00
Loads
                                                .0000E+00
        MEM -.2647E+03
                         .1377E+05 -.1111E+04
Stress
                                                .1386E+05 -.3521E+03
                                                                         -85.5
                          ***QUAD PLATE NO.
                                              58***
             .3338E+04 -.1093E+04
                                                                       .0000E+00
Loads
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
            .3040E+04 -.1549E+04
         56
                                                                       .0000E+00
Loads
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
         63 -.3245E+04
                                                            .0000E+00
Loads
                         .1054E+04
                                     .0000E+00
                                                .0000E+00
                                                                       .0000E+00
Loads
         62 -.3133E+04
                         .158BE+04
                                    .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
                         .1377E+05 -.1111E+04
        MEM -.2646E+03
                                                                         -85.5
Stress
                                                .1386E+05 -.3520E+03
                          ***CUAD PLATE NO.
                                              59***
             .346BE+04 -.5573E+03
                                    .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
         62
Loads
         63
             .3245E+04 -.1054E+04
Loads
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
Loads
         70 -.3370E+04
                         .5337E+03
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
         69 -.3343E+04
                         .1078E+04
                                                                       .0000E+00
Loads
                                    .0000E+00
                                                .0000E+00
                                                            .0000E+00
Stress
        MEM -.2646E+03
                         .1377E+05 -.1111E+04
                                                .1386E+05 -.3521E+03
                                                                         -85.5
                          ***QUAD PLATE NO.
                                              60***
             .3513E+04 -.7924E+01
         69
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
Loads
Loads
         70
            .3370E+04 -.5337E+03
                                    .0000E+00
                                                .0000E+00
                                                           .0000E+00
                                                                       .0000E+00
                                                            .0000E+00
Loads
         77 -.3412E+04 .1491E-08
                                    .0000E+00
                                                .0000E+00
                                                                       .0000E+00
                                                           .0000E+00
         76 -.3471E+04 .5416E+03 .0000E+00
Loads
                                                .0000E+00
                                                                       .0000E+00
        MEM -.2646E+03 .1377E+05 -.1111E+04
Stress
                                                .1386E+05 -.3521E+03
                                                                         -85.5
```

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SOLVE PLATE LOADS/STRESSES Version 1.1 02/01/85

LTHD muzzle brake thermal load - titanium

MAXIMUM STRESS SUMMARY FOR PLATES WITHIN SPECIFIED RANGE

Maximum (absolute) Stress = .2079E+05 at Plate 8

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SOLVE REACTIONS

Version 1.1 02/01/85

REACTIONS

Node 	Fx	Fy	Fz	Мж 	My	Mz
1	.0000E+00	.4228E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
2	.0000E+00	.7086E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
3	.0000E+00	.3456E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
4	.0000E+00	1095E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
5	.0000E+00	4221E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
6	.0000E+00	6042E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
フ	.0000E+00	3412E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
71	.4228E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
72	.7086E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
73	.3455E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
74	1095E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
75	422					

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SOLVE DISPLACEMENTS

Version 1.1 02/01/85

LTHD muzzle brake thermal load - steel

LDAD CASE 1

REFERENCE TEMPERATURE =-.2500E+02

PLATE TEMPERATURES

Plate	Temp	Plate	Temp	Plate	Temp	Plate	Temp
1	.2310E+03	2	.2310E+03	3	.2310E+03	4	.2310E+03
5	.2310E+03	6	.2310E+03	7	.2310E+03	8	.2310E+03
9	.2310E+03	10	.2310E+03	11	.1884E+03	12	.1884E+03
13	.1884E+03	14	.1884E+03	15	.1884E+03	16	.1884E+03
17	.1884E+03	18	.1884E+03	19	.1884E+03	20	.1884E+03
21	.1409E+03	22	.1409E+03	23	.1409E+03	24	.1409E+03
25	.1409E+03	26	.1409E+03	27	.1409E+03	28	.1409E+03
29	.1409E+03	30	.1409E+03	31	.9350E+02	32	.9350E+02
33	.9350E+02	34	.9350E+02	35	.9350E+02	36	.9350E+02
37	.9350E+02	38	.9350E+02	39	.9350E+02	40	.9350E+02
41	.4610E+02	42	.4610E+02	43	.4610E+02	44	.4610E+02
45	.4610E+02	46	.4610E+02	47	.4610E+02	48	.4610E+02
49	.4610E+02	50	.4610E+02	51	1300E+01	52	1300E+01
53	1300E+01	54	1300E+01	55	1300E+01	56	1300E+01
57	1300E+01	58	1300E+01	59	1300E+01	60	1300E+01

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SOLVE DISPLACEMENTS

Version 1.1 02/01/85

LTHD muzzle brake thermal load - steel

LOAD CASE 1

Node	Fx	Fy	Fz	M ×	My	Mz
1	3326E+05	1570E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
2	.5903E+04	2812E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
3	.7079E+04	2539E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
4	.7570E+04	1892E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
5	.8075E+04	1245E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
6	.8581E+04	5983E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
フ	.4543E+04	1368E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
8	6569E+05	1040E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
9	.1166E+05	.1843E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
10	.1398E+05	.2218E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
1 1	.1495E+05	.2366E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
12	.1595E+05	.2529E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
13	.1695E+05	.26B4E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
14	.8974E+04	.1422E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
15	6326E+05	2055E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
16	.1123E+05	.3648E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
17	.1347E+05	.4375E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
18	.1440E+05	.4678E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
19	.1536E+05	.4989E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
20	.1632E+05	.5304E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
21	.8641E+04	.2808E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
22	5926E+05	3020E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
23	.1052E+05	.5359E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
24	.1262E+05	.6425E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
25	.1349E+05	.6878E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
26	.1439E+05	.7332E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
27	.1529E+05	.7790E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
28	.8096E+04	.4125E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
29 70	5381E+05	3909E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
30 3 4	.9550E+04	.6938E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
31 70	.1145E+05	.8322E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
32 77	.1225E+05	.8679E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
33 74	.1307E+05	.9493E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
34 35	.7351E+04	.1009E+03	.0000E+00	.0000E+00	.0000E+00	.0000E+00 .0000E+00
ან	./SSIE+04	. 33406704	.000006+00	.0000E+00	.0000E+00	. 00000

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SOLVE DISPLACEMENTS

Version 1.1 02/01/85

LTHD muzzle brake thermal load - steel

LOAD CASE 1

Node	F×	Fy	Fz	Мж	My	Mz
36	4703E+05	4703E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
37	.8347E+04	.8347E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
38	.1001E+05	.1001E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
39	.1071E+05	.1070E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
40	.1142E+05	.1142E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
41	.1213E+05	.1214E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
42	.6425E+04	.6425E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
43	3909E+05	5381E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
44	.6935E+04	.9553E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
45	.8328E+04	.1145E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
46	.8898E+04	.1225E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
47	.9490E+04	.1307E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
48	.1009E+05	.1388E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
49	.5340E+04	.7351E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
50	3020E+05	5926E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
51	.5360E+04	.1052E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
52	.6424E+04	.1262E+05	.0000E+00	.000E+00	.0000E+00	.0000E+00
5 3	.6876E+04	.1349E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
54	.7334E+04	.1439E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
55	.7790E+04	.1529E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
56	.4125E+04	.8095E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
5 7	2055E+05	6326E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
58	.3652E+04	.1123E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
59	.4372E+04	.1347E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
60	.4678E+04	.1440E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
61	.4991E+04	.1536E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
62	.5303E+04	.1632E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
63	.2808E+04	.8641E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
64	1040E+05	6569E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
65	.1847E+04	.1166E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
66	.2218E+04	.1398E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
67	.2363E+04	.1495E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
68	.2527E+04	.1595E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
69 70	.2686E+04	.1695E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
70	.1421E+04	.8974E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
71	1570E+05	3326E+05	.0000E+00	.0000E+00	.0000E+00	.0000E+00
72 73	2812E+05	.5902E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
73 74	2539E+05	.7079E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
74 75	1891E+05	.7570E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
75	1245E+05	.8075E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00

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SOLVE DISPLACEMENTS

Version 1.1 02/01/85

LTHD muzzle brake thermal load - steel

LOAD CASE 1

Node	Fx	Fy	Fz	M×	My	Mz	
76	5983E+04	.8581E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00	
フフ	1368E+04	.4543E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00	

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SOLVE DISPLACEMENTS

STATE OF THE PROPERTY.

Version 1.1 02/01/85

LTHD muzzle brake thermal load - steel

LOAD CASE 1

DISFLACEMENTS

		nslati	ons	/	₽o	tatio	
Node	X	Υ	Z	/	X	Υ	Z
1	.5191E-02	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
2	.5953E-02	.0000E+00	.0000E+00		.0000E+00	.0000E+00	.0000E+00
3	.6697E-02	.0000E+00	.0000E+00		.0000E+00	.0000E+00	.0000E+00
4	.7226E-02	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
5	.7556E-02	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
6	.7697E-02	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
7	.7659E-02	.0000E+00	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
8	.5127E-02	.8120E-03	.0000E+00	1	.0000E+00	.0000E+00	.0000E+00
9	.5880E-02	.9313E-03	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
10	.6615E-02	.104BE-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
11	.7137E-02	.1130E-02	.0000E+00	1	.0000E+00	.0000E+00	.0000E+00
12	.7463E-02	.1182E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
13	.7602E-02	.1204E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
14	.7564E-02	.1198E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
15	.4937E-02	.1604E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
16	.5662E-02	.1840E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
17	.6369E-02	.20 69E- 02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
18	.6B72E-02	.2233E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
19	.7186E-02	.2335E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
20	.7320E-02	.237BE-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
21	.7284E-02	.2367E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
22	.4625E-02	.2357E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
23	.5304E-02	.2703E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
24	.5967E-02	.3040E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
25	.6439E-02	.3281E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
26	.6732E-02	.3430E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
27	.6858E-02	.3494E-02		/	.0000E+00	.0000E+00	.0000E+00
28	.6824E-02	.3477E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
29	.4200E-02	.3051E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
30	.4816E-02	.3499E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
31	.5418E-02	.3936E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
32	.5846E-02	.4247E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
33	.6113E-02	.4441E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
34	.6227E-02	.4524E-02		/	.0000E+00	.0000E+00	.0000E+00
35	.6196E-02	.4502E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
36	.3671E-02	.3671E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
37	.4209E-02	.4209E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
28	.4736E-02	.4736E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
39	.5110E-02	.5110E-02	.0000E+00	′.	.0000E+00	.0000E+00	.0000E+00
40	.5343E-02	.5343E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

SOLVE DISPLACEMENTS

Version 1.1 02/01/85

LTHD muzzle brake thermal load - steel

LOAD CASE 1

	Tra	nslati	ons.	/	fi o	tatio	n s
Node	X	Υ	Ζ.	/	X	Y	Z
41	.5442E-02	.5442E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
42	.5415E-02	.5415E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
43	.3051E-02	.4200E-02	.0000E+00	-	.0000E+00	.0000E+00	.0000E+00
44	.3499E-02	.4816E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
45	.3936E-02	.5418E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
46	.4247E-02	.5846E-02	.0000E+00	-	.0000E+00	.0000E+00	.0000E+00
47	.4441E-02	.6113E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
48	.4524E-02	.6227E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
49	.4502E-02	.6196E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
50	.2357E-02	.4625E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
51	.2703E-02	.5304E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
52	.3040E-02	.5967E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
5 3	.32B1E-02	.6438E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
54	.3430E-02	.6732E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
5 5	.3494E-02	.6858E-02	.0000E+00		.0000E+00	.0000E+00	.0000E>00
56	.3477E-02	.6824E-02	.0000E+00		.0000E+00	.0000E+00	.0000E+00
57	.1604E-02	.4937E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
58	.1840E-02	.5662E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
59	.2069E-02	.6369E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
60	.2233E-02	.6872E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
61	.2335E-02	.7186E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
62	.2378E-02	.7320E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
63	.2367E-02	.7284E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
64	.8121E-03	.5127E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
65	.9313E-03	.5880E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
66	.1048E-02	.6615E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
67	.1130E-02	.7137E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
68	.1182E-02	.7462E-02	.0000E+00 .	/	.0000E+00	.0000E+00	.0000E+00
69	.1204E-02	.7602E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
70	.1198E-02	.7564E-02	.0000E+00 .	/	.0000E+00	.0000E+00	.0000E+00
71	.0000E+00	.5191E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
72	.0000E+00	.5953E-02	.0000E+00 .		.0000E+00	.0000E+00	.0000E+00
73	.0000E+00	.6697E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00
74	.0000E+00	.7226E-02	.0000E+00	/	.0000E+00	.0000E+00	.0000E+00

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SOLVE PLATE LOADS/STRESSES Version 1.1 02/01/85

LTHD muzzle brake thermal load - steel

CONTRACTOR OF CANADAS CONTRACTOR OF CONTRACTOR OF CANADAS CONTRACT

PLATE LOADS AND/OR STRESSES

	Loads	Node	F×		Fy		Fz	M×		My		Mz	
	Stress	Surf	Sigma		Sigma	Υ	Tau XY	Sigma	1	Sigma	2	Angle	
	Stress		Shear	ΧZ	Shear	ΥZ							
							. ATE NO	1 0 0 0					-
	Loads	1	. 1346	E_00	. 4770E		'LATE NO.	.0000E	·+00	.0000E	400	00005.0	0
	Loads	_	7379		.4606		.0000E+00			.0000E		.0000E+0	
	Loads		8359				.0000E+00			.0000E		.0000E+0	
	Loads	8	.7462		47128		.0000E+00			.0000E		.0000E+0	
	Stress				2346		.1781E+04					4.5	
	00, 000		. ,				LATE NO.	2***		. 20002		7.5	
	Loads	8	74621	E+03	.4712		.0000E+00	_	+00	.0000E	+00	.0000E+0	Ó
	Loads		1449		.44336		.0000E+00			.0000E		.0000E+0	_
	Loads	16			46088		.0000E+00	.0000E		.0000E		.0000E+0	
	Loads	15	. 1474				.0000E+00	.0000E		.0000E		.0000E+0	
	Stress	MEM	96608	E+03	2346E	E+05	.1781E+04	8259E	+03	2360E	+05	4.5	_
					D(JAD F	LATE NO.	3					
	Loads	15	1474	E+04	.4537E	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0	Ō
	Loads	16	2125	E+04	.41526	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0	O
	Loads	23	. 14336	E+04	4439E	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0	O
	Loads	22	. 2166	E+04	4250E	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0	O
	Stress	MEM	9660	E+03	2346E		.1781E+04	8258E	+03	2360E	+05	4.5	
							LATE NO.	4***					
	Loads		2166		.4250		.0000E+00	.0000E		.0000E		.0000E+0	
	Loads		2748		.37698		.0000E+00			.0000E		.0000E+0	
	Loads	30	.2110				.0000E+00	.0000E		.0000E		.0000E+0	
	Loads	29	. 2804				.0000E+00			.0000E		.0000E+0	Ō
(Stress	MEM	9660	E+03	2346E		.1781E+04		+03	2360E	+05	4.5	
`							LATE NO.	5***					
	Loads		2804		.38598		.0000E+00	.0000E		.0000E		.0000E+0	
	Loads		3304		.32926		.0000E+00			.0000E	-	.0000E+0	
	Loads	37			37788		.0000E+00	.0000E		.0000E		.0000E+0	
	Loads	36			3373E		.0000E+00	.0000E		.0000E		.0000E+0	U
	Stress	FIEFI	7000	E+U3	23468		.1781E+04	8258E	+02	2360E	+05	4.5	
	Loads	74	3373	E+04	.3373E		.0000E+00	_	±00	.0000E	400	.0000E+0	۵
	Loads		3778i		.27358		.0000E+00			.0000E	• -	.0000E+0	
	Loads	44			3304E		.0000E+00	.0000E		.0000E		.0000E+0	
	Loads	43	.3859				.0000E+00	.0000E		.0000E		.0000E+0	
	Stress				2346E		.1781E+04	B259E		2360E		4.5	•
	C. 635	1 14-1	. ,				LATE NO.	7***		* 2000		7.0	
	Loads	43	3859	E+04	28046		.0000E+00	.0000E	+00	.0000E	+00	.0000E+0	Ō
	Loads		4160		.21108		.0000E+00	.0000E		.0000E	-	.0000E+0	
													-

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CX CX

Loads	Node	Fx	Fγ	Fz	Mx	My	Mz
Stress Stress	Sur+	Sigma X Shear XZ	Sigma Y Shear YZ	Tau XY	Sigma 1	Sigma 2	Angle
Loads	51	.3769E+04	2748E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	50	.4250E+04	2166E+04	.0000E+00	.0000E+00	.0000E+00	.00000E+00
Stress	MEM	9660E+03	2346E+05	.1781E+04	8258E+03	2360E+05	4.5
			DUAD P	LATE NO.	8		
Loads	50	4250E+04	.2166E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	51	4439E+04	.1433E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	58	.4152E+04	2125E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	57	.4537E+04	1474E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	9660E+03	2346E+05	.1781E+04	8258E+03	2360E+05	4.5
			@UAD F	LATE NO.	9		
Loads	57	4537E+04	.1474E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	58	4608E+04	.7214E+03	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	65	.4433E+04	1449E+Q4	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	64	.4711E+04	7462E+03	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	9660E+03	2346E+05	.1781E+04	8258E+03	2360E+05	4.5
			DUAD P	LATE NO. :	10		
Loads	64	4711E+04	.7462E+03	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	65	4664E+04	8351E+01	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	72	.4606E+04	7379E+03	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	71	.4770E+04	1746E-09	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	- .96 60E+03	2346E+05	.1781E+04	8258E+03	2360E+05	4.5
			QUAD F	LATE NO. :	11		
Loads	2	.7379E+03	.3645E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	3	1295E+04	.3437E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	10	7417E+03	3597E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	9	.1299E+04	3485E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	2051E+04	1419E+05	.9614E+03	1975E+04	1426E+05	4.5
			QUAD F	LATE NO. :	12		
Loads	9	.1584E+03	.3716E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	10	1817E+04	.3192E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	17	1699E+03	3668E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	16	.1829E+04	3240E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	2051E+04	1419E+05	.9614E+03	1975E+04	1426E+05	4.5
			QUAD P	LATE NO. :	13		
Loads	16	4249E+03	.3696E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	17	2294E+04	.2868E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	24	.4060E+03	3650E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Loads	23	.2313E+04	2914E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
Stress	MEM	2051E+04	1419E+05	.9611E+03	1975E+04	1426E+05	4.5
			QUAD F	LATE NO. 1	L4		
Loads	23	- .9978E +03	.3584E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00

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Stress

```
Fy
                 Fx
Loads
       Node
                                        Fz
                                                    М×
                                                                My
                                                                           MΞ
Stress Surf
              Sigma
                    X
                         Sigma
                                Y
                                      Tau XY
                                                 Sigma
                                                             Sigma
                                                                          Angle
              Shear XZ
                         Shear YZ
Stress
                         .2474E+04
         24 -.2714E+04
                                                 .0000E+00
                                                             .0000E+00
                                                                         .0000E+00
Loads
                                     .0000E+00
              .9720E+03 -.3542E+04
Loads
         31
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
         30
             .2740E+04 -.2516E+04
Loads
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
        MEM -.2051E+04 -.1419E+05
                                     .9610E+03 -.1975E+04 -.1426E+05
Stress
                                                                             4.5
                          ***CUAD PLATE NO. 15***
         30 -.1546E+04
                                                .0000E+00
                                                             .0000E+00
Loads
                          .3383E+04
                                     .0000E+00
                                                                        .0000E+00
         31 -.3068E+04
Loads
                         .2019E+04
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
Loads
              .1514E+04 -.3346E+04
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
                                                 .0000E+00
Loads
         37
              .3100E+04 ~.2056E+04
                                     .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
Stress
        MEM -.2051E+04 -.1419E+05
                                     .9611E+03 -.1975E+04 -.1426E+05
                                                                            4.5
                          ***QUAD FLATE NO.
                                               16***
                                     .0000E+00
                                                 .0000E+00
Loads
         37 -.2056E+04
                         .3100E+04
                                                             .0000E+00
                                                                        .0000E+00
                         .1514E+04
                                                                        .0000E+00
Loads
         38 -.3346E+04
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                 .0000E+00
Loads
             .2019E+04 -.3068E+04
                                     .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
             .3383E+04 -.1546E+04
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
Loads
                                     .0000E+00
        MEM -.2051E+04 -.1419E+05
                                                                             4.5
Stress
                                     .9609E+03 -.1975E+04 -.1426E+05
                          ***QUAD PLATE NO. 17***
         44 -. 2516E+04
                         .2740E+04
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
Loads
                         .9722E+03
         45 -.3542E+04
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
Loads
         52
              .2474E+04 -.2715E+04
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
Loads
                                     .0000E+00
         51
              .3583E+04 -.9975E+03
Loads
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
        MEM -.2051E+04 -.1419E+05
                                     .9608E+03 -.1975E+04 -.1426E+05
Stress
                                                                             4.5
                          ***QUAD PLATE NO. 18***
                         .2312E+04
            -.2913E+04
                                                             .0000E+00
         51
                                     .0000E+00
                                                 .0000E+00
                                                                        .0000E+00
Loads
         52
            -.3651E+04
                         .4062E+03
Loads
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
         59
              .2868E+04
                        -.2294E+04
Loads
                                                 .0000E+00
              .3695E+04
                                                             .0000E+00
Loads
         58
                        -.4247E+03
                                     .0000E+00
                                                                        .0000E+00
        MEM -. 2051E+04
                                     .9614E+03 -.1975E+04 -.1426E+05
                        -.1419E+05
                                                                            4.5
Stress
                          ***QUAD PLATE NO.
                                               19***
Loads
         58 -.3239E+04
                         .1828E+04
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
         59 -.3669E+04 -.1700E+03
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
Loads
             .3192E+04 -.1817E+04
                                                 .0000E+00
                                                            .0000E+00
                                                                        .0000E+00
                                     .0000E+00
Loads
         66
             .3717E+04
                                                                        .0000E+00
                         .1585E+03
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
Loads
         65
        MEM -.2051E+04 -.1419E+05
                                     .9612E+03 -.1975E+04 -.1426E+05
                                                                             4.5
Stress
                          ***QUAD PLATE NO. 20***
         65 -.3486E+04
                         .1299E+04
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
Loads
         66 -.3597E+04 -.7418E+03
                                     .0000E+00
                                                 .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
Loads
                                                 .0000E+00
              .3436E+04 -.1295E+04
                                     .0000E+00
                                                             .0000E+00
         73
                                                                        .0000E+00
Loads
                         .7379E+03
                                                .0000E+00
                                                             .0000E+00
                                                                        .0000E+00
Loads
         72
              .3646E+04
                                     .0000E+00
```

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4.5

.9610E+03 -.1975E+04 -.1426E+05

Version 1.1 02/01/85

MEM -.2051E+04 -.1419E+05

```
Fχ
Load∈
       Node
                             Fy
                                         Fz
                                                     М×
                                                                 My
                                                                             Mz
Stress Surf
              Sigma
                     X
                          Sigma
                                       Tau XY
                                                  Sigma
                                                              Sigma
                                                                            Angle
              Shear XZ
                          Shear YZ
                           ***QUAD FLATE NO.
                                                21***
              .1295E+04
                          .1234E+04
                                                  .0000E+00
                                                              .0000E+00
Loads
                                      .0000E+00
                                                                          .0000E+00
Loads
            -.1477E+04
                          .1069E+04
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
                                                                          .0000E+00
             -.1291E+04 -.1287E+04
Loads
          11
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
                                                                          .0000E+00
Loads
          10
              .1473E+04 -.1017E+04
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
                                                                          .0000E+00
        MEM -.2475E+04 -.4632E+04
Stress
                                      .1708E+03 -.2462E+04
                                                             -.4645E+04
                                                                              4.5
                           ***OUAD PLATE NO.
                                                22***
Loads
          10
              .1086E+04
                          .1422E+04
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
                                                                          .0000E+00
Loads
            -.1626E+04
                          .8249E+03
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
                                                                          .0000E+00
                                                              .0000E+00
Loads
          18
            -.1074E+04 -.1473E+04
                                      .0000E+00
                                                  .0000E+00
                                                                          .0000E+00
              .1613E+04 -.7739E+03
                                                                          .0000E+00
Loads
          17
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
Stress
        MEM -.2475E+04 -.4632E+04
                                      .1708E+03 -.2462E+04
                                                             -.4646E+04
                                                                              4.5
                           ***QUAD PLATE NO.
                                               23***
              .8503E+03
                          .1574E+04
                                                              .0000E+00
                                                                          .0000E+00
Loads
                                      .0000E+00
                                                  .0000E+00
                          .5604E+03
                                                              .0000E+00
Loads
          18 -.1735E+04
                                      .0000E+00
                                                  .0000E+00
                                                                          .0000E+00
          25
            -.8303E+03 -.1623E+04
                                                  .0000E+00
                                                              .0000E+00
                                                                          .0000E+00
Loads
                                      .0000E+00
          24
              .1715E+04 -.5120E+03
                                                  .0000E+00
                                                              .0000E+00
                                                                          .0000E+00
Loads
                                      .0000E+00
        MEM -.2475E+04 -.4632E+04
                                      .1709E+03 -.2462E+04
                                                            -.4646E+04
                                                                              4.5
Stress
                           ***QUAD FLATE NO.
                                               24***
              .5935E+03
                                                                          .0000E+00
          24
                          .1688E+04
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
Loads
            -.1801E+04
                          .2819E+03
                                                  .0000E+00
                                                              ,0000E+00
                                                                          .0000E+00
Loads
                                      .0000E+00
Loads
          32 -.5664E+03 -.1733E+04
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
                                                                          .0000E+00
              .1774E+04 -.2376E+03
                                                                          .0000E+00
Loads
          31
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
        MEM -.2475E+04 -.4632E+04
                                      .1708E+03 -.2462E+04 -.4646E+04
                                                                              4.5
Stress
                                               25***
                           ***QUAD PLATE NO.
              .3221E+03
                                                                          .0000E+00
Loads
         31
                          .1760E+04
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
Loads
          32 -.1823E+04 -.3373E+01
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
                                                                          .0000E+00
                                                                         .0000E+00
Loads
          39 -.2883E+03 -.1800E+04
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
                          .4286E+02
Loads
              .1789E+04
                                                              .0000E+00
         38
                                      .0000E+00
                                                  .0000E+00
                                                                          .0000E+00
        MEM -.2475E+04 -.4632E+04
                                                                              4.5
                                      .1705E+03 -.2462E+04
                                                            -.4645E+04
Stress
                           ***QUAD PLATE NO.
                                               26***
              .4296E+02
                          .1789E+04
                                                              .0000E+00
                                                                         .0000E+00
Loads
                                      .0000E+00
                                                  .0000E+00
Loads
            -.1800E+04 -.2883E+03
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
                                                                          .0000E+00
Loads
         46 -.3209E+01 -.1823E+04
                                                              .0000E+00
                                                                         .0000E+00
                                      .0000E+00
                                                  .0000E+00
          45
              .1760E+04
                          .3222E+03
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
                                                                          .0000E+00
Loads
        MEM -.2475E+04 -.4632E+04
                                      .1709E+03 -.2462E+04
                                                            -.4646E+04
Stress
                                                                              4.5
                           ***QUAD PLATE NO.
                                                27***
                                                                          .0000E+00
Loads
          45 -.2375E+03
                          .1774E+04
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
          46 -.1733E+04 -.5664E+03
                                                                         .0000E+00
Loads
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
Loads
         53
              .2818E+03 -.1801E+04
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
                                                                          .0000E+00
Loads
          52
              .1688E+04
                          .5936E+03
                                      .0000E+00
                                                  .0000E+00
                                                              .0000E+00
                                                                          .0000E+00
```

፞ዸጜዸኇ፞ፙኇ፞ጟኇ፞ጟኇ፞ጟጜጜጜጜጜጜጜጜጜጜጜጜጜጜጜጜጜጜጜጜጜጜጜጜ

		_		_							
Loads	Node	Fx	v	Fy	V	Fz. VV	Mx Galana		My	_	Mz
Stress Stress	Surt	Sigma Shear	X X Z	Sigma Shear		Tau XY	Sigma	1	Sigma	2	Ang1e
3tress	MEM	24758	 E+04	4632	 F+04	.1710E+03		+04		+04	4.5
							28***	• •			7.0
Loads	52	51208	E+03	. 1715		.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	53	1623E	E+04	8304	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	60	.56048	E+03	1735	E+04	.0000E+00	.0000E		.0000E		.0000E+0
Loads	59	.1574E	E+04	.8504	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Stress	MEM	2475E	E+04	4632	E+04	.1705E+03	2462E	+04	4645E	+04	4.5
				Q!	JAD F	LATE NO. 2	29				
Loads	59	7739E	E+03	. 1613	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	60	1473E	E+04	1074	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	67	.82486	E+03	1626	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	66	.14228	E+04	. 1086	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Stress	MEM	24758	E+04	4632	E+04	.1708E+03	2462E	+04	4646E	+04	4.5
				Q(JAD F	LATE NO. 3	30				
Loads	66	1017E	E+04	. 1472	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	67	1287E	E+04	1291	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	74	.1069E	E+04	1477	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	73	.1235E	E+04	. 1295	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Stress	MEM	2475E	E+04	4632	E+04	.1709E+03	2462E	+04	4645E	+04	4.5
				Q(JAD F		31				
Loads	4	. 1477E	E+04	10158	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	5	1309E	+04	1115	E+04	.0000E+00	.0000E		.0000E	+00	.0000E+0
Loads	12	14688	E+04	. 90061	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	11	.1300E		.1234	E+Q4	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Stress	MEM	2245E	E+04			5143E+03	.4289E	+04	2286E	+04	-85.5
							32***				
Loads	11			7722		.0000E+00	.0000E	+00	.0000E	+QQ	.0000E+0
Loads		1117E		13106	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	19	1590E		. 66001		.0000E+00	.0000E	+00	.0000E	+ 00	.0000E+0
Loads	18	.1091E		. 1422		.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Stress	MEM	22458	E+04	. 42491	E+04	5141E+03	.4289E	+04	2286E	+04	-85.5
							33***				
Loads	18			5095		.0000E+00	.0000E	+00	.0000E		.0000E+0
Loads	_	89878				.0000E+00	.0000E		.0000E		.0000E+0
Loads		1674E		. 4029		.0000E+00	.0000E		.0000E		.0000E+0
Loads	25	.8546E		. 1575		.0000E+00	.0000E		.0000E		.0000E+0
Stress	MEM	2245E	E+04			5142E+03	.4289E	+04	2286E	+04	-85.5
							34***				
Loads	25	_		2343		.0000E+00	.0000E		.0000E		.0000E+0
Loads		6577E				.0000E+00	.0000E		.0000E		.0000E+0
Loads	33	1716E	E+04	. 1361	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0

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Loads Stress Stress	Node Surf	Fx Sigma Shear	X X Z	Fy Sigma Shear	Y YZ	Fz Tau XY	Mx Sigma	1	My Sigma	2	Mz Angle
Stress	MEM	22458	 E+04	.42498	E+04	5146E+03		+04		+04	
				01	JAD F	LATE NO. 3	5				
Loads	32	.17928	E+04	.4632	E+02	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	33	4010E	E+03	1675E	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	40	1717E	+04	13398	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	39	.3262E	E+03	.17628	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	22458	E+04	.4249	E+04	5141E+03	.4289E	+04	2286E	+04	-85.5
				###@(JAD F	LATE NO. 3	6***				
Loads	39	.1762E	E+04	.32618	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	40	1340E	E+03	1717E	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	47	1674E	E+04	4010	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	46	.4634E	E+02	.17918	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	2245E	E+04	. 42498	E+04	5143E+03	.4289E	+04	2286E	+04	-85.5
				QL	JAD F	PLATE NO. 3	7				
Loads	46	.1690E	+04	.59778	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	47	.1362E	E+03	1716E	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	54	1591E	+04	6580	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	53	2345E	E0+3	. 1777E	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	2245E	E+04	. 42496	E+04	5144E+03	.4289E	+04	2286E	+04	-85.5
				# * *@i	JAD F	PLATE NO. 3	8***				
Loads	53	.1575E	+04	.85458	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	54	.40288	20+	1674E	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	61	1469E	E+04	89878	E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	60	50958	E+03	.1718	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	2245E	E+04	.4249	E+04	5141E+03	.4289E	+04	2286E	+04	-85.5
				@(JAD F	LATE NO. 3	9				
Loads	60	.1422E	+04	.10916	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	61	.6600E	E+03	1590E	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	68	1310E	+04	1117E	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	67	7722E	+03	.1617	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	2245E	+04	. 42496	E+04	5144E+03	.4289E	+04	2286E	+04	-85.5
				Qt	JAD F	LATE NO. 4	()				
Loads	67	.12346	+04	.1300E	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	68	. 9007E	+03	14688	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	75	11198	+04	13098	E+04	.0000E+00	.0000E	QQ+	.0000E	+00	.0000E+00
Loads	74	1016E	+04	. 1477E	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	2245E	E+04	. 42498	E+04	5144E+03	.4289E	+04	2286E	+04	-85.5
				D(JAD F	PLATE NO. 4	1				
Loads	5	.13098	+04	31508	E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	6	81158	E+03	31698	E+Q4	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	17	1297E		.3004E		.0000E+00	.0000E	* OO	.0000E	100	.0000E+00

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```
Fy
                 Fx
Loads
       Node
                                        Fz
                                                   Mx
              Sigma
                    X
                         Sigma
Stress Surf
                                      Tau XY
                                                Sigma
                                                            Sigma
                                                                          Anale
             Shear XZ
                         Shear YZ
Stress
        MEM -. 1515E+04
                         .1263E+05 -.1120E+04
Stress
                                                .1272E+05 -.1604E+04
                                                                          -85.5
                          ***QUAD FLATE NO.
                                              42***
             .1785E+04 -.2906E+04
Loads
                                    .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                        .0000E+00
Loads
         13 -.3053E+03 -.3257E+04
                                     .0000E+00
                                                            .0000E+00
                                                .0000E+00
                                                                       .0000E+00
         20 -.1751E+04
                         .2764E+04
                                                .0000E+00
                                                            .0000E+00
Loads
                                     .0000E+00
                                                                        .0000E+00
             .2710E+03
                                     .0000E+00
Loads
         19
                         .3400E+04
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
        MEM -.1515E+04
Stress
                         .1263E+05 -.1120E+04
                                                .1272E+05 -.1603E+04
                                                                         -85.5
                          ***DUAD FLATE NO.
                                              43***
         19
             .2218E+04 -.2592E+04
                                     .0000E+00
                                                            .0000E+00
                                                .0000E+00
Loads
                                                                       .0000E+00
             .2079E+03 -.3265E+04
         20
Loads
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
                        .2456E+04
Loads
         27 -.2162E+04
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
Loads
         26 -.2644E+03
                         .3401E+04
                                     .0000E+00
                                                .0000E+00
                                                           .0000E+00
                                                                       .0000E+00
Stress
        MEM -.1515E+04
                         .1263E+05 -.1120E+04
                                                .1272E+05 -.1603E+04
                                                                         -85.5
                          ***QUAD FLATE NO. 44***
         26
             .2596E+04 -.2213E+04
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
Loads
Loads
         27
             .7160E+03 -.3192E+04
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
                         .2087E+04
Loads
         34 -.2519E+04
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
                                     .0000E+00
         33 -.7927E+03
                                                            .0000E+00
Loads
                         .3317E+04
                                                .0000E+00
                                                                       .0000E+00
        MEM -.1515E+04
Stress
                         .1263E+05 -.1120E+04
                                                .1272E+05 -.1603E+04
                                                                         -85.5
                          ***DUAD FLATE NO.
                                              45***
             .2910E+04 -.1779E+04
Loads
         33
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
             .1207E+04 -.3041E+04
                                                            .0000E+00
                                                                       .0000E+00
Loads
                                     .0000E+00
                                                .0000E+00
         41 -.2815E+04
                        .1667E+04
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
Loads
                                     .0000E+00
         40 -.1302E+04
Loads
                         .3153E+04
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
Stress
        MEM -.1515E+04
                         .1263E+05 -.1121E+04
                                                .1272E+05 -.1603E+04
                                                                         -85.5
                          ***QUAD PLATE NO. 46***
                                     .0000E+00
                                                                       .0000E+00
Loads
         40
             .3153E+04 -.1302E+04
                                                .0000E+00
                                                            .0000E+00
              .1667E+04 -.2815E+04
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
                                     .0000E+00
Loads
         41
         48 -.3041E+04
                        .1207E+04
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
Loads
                                     .0000E+00
         47 -.1779E+04
                         .2910E+04
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
Loads
        MEM -.1516E+04
                         .1263E+05 -.1120E+04
                                                .1272E+05 -.1604E+04
                                                                         -85.5
Stress
                          ***DUAD FLATE NO.
                                              47***
         47
              .3318E+04 -.7929E+03
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
Loads
             .2087E+04 -.2519E+04
                                     .0000E+00
Loads
         48
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
         55 -.3192E+04
                         .7162E+03
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
Loads
                                     .0000E+00
                                     .0000E+00
                                                            .0000E+00
Loads
         54 -.2213E+04
                         .2596E+04
                                                .0000E+00
                                                                       .0000E+00
                         .1263E+05 -.1120E+04
        MEM -.1515E+04
                                                .1272E+05 -.1603E+04
                                                                         -85.5
Stress
                          ***QUAD FLATE NO. 48***
         54
             .3401E+04 -.2641E+03
                                                            .0000E+00
                                                                       .0000E+00
Loads
                                   .0000E+00
                                                .0000E+00
             .2456E+04 -.2162E+04
                                     .0000E+00
                                                .0000E+00
                                                            .0000E+00
                                                                       .0000E+00
Loads
```

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.0000E+00

.0000E+00

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.0000E+00

.0000E+00

62 -.3265E+04 .2077E+03

Loads

Loads	Node	Fx	Fy	Fz	Mx		My		Mz
Stress	Surf	Sigma)	(Sigma Y	Tau XY	Sigma	1	Sigma	2	Angle
Stress		Shear XZ	Shear YZ					_	
Stress	MEM	1515E+0	04 .1263E+05	1120E+04	.1272E	+05	1604E	+04	-85.5
			QUAD	FLATE NO. 4	19				
Loads	61	.3401E+0	04 .2709E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	62	.2763E+0	041751E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	69	3257E+0	043054E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	68	2907E+0	04 .1785E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Stress	MEM	1515E+0	04 .1263E+05	1120E+04	.1272E	+05	1603E	+04	-85.5
			DUAD	PLATE NO. 5	50				
Loads	68	.3316E+0	04 .7997E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	69	.3004E+0	941297E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	76	3170E+0	048112E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	75	3150E+0	04 .1309E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Stress	MEM	1515E+0	04 .1263E+05	1120E+04	.1272E	+05	1603E	+04	-85.5
			QUAD	PLATE NO. 5	51				
Loads	6	.8115E+0	035198E+04	.0000E+00	.0000E		.0000E	+00	.0000E+0
Loads	7	2364E-0	085110E+04	.0000E+00	.0000E	+00	.0000E		.0000E+0
Loads	14	7994E+0	03 .5046E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	13	1209E+0	02 .5261E+04	.0000E+00	.0000E	+ 00	.0000E	+00	.0000E+0
Stress	MEM	3962E+0	03 .20 62E +05	1665E+04	.2075E	+05	5273E	+03	-85.5
			QUAD	PLATE NO. 5	52				
Loads	13	.1614E+0	045008E+04	.0000E+00	.0000E	+00	.0000E		.0000E+0
Loads	14	.7994E+0	035046E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	21	1579E+0	04 .4859E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	20	8351E+0			.0000E	+00	.0000E	+00	.0000E+0
Stress	MEM	3965E+0	03 .2062E+05	1665E+04	.2075E	+05	5275E	+03	-85.5
			QUAD	FLATE NO. 5	53				
Loads	20	.2378E+0	044694E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	21	.1579E+0	044859E+04		.0000E	+00	.0000E	+00	.0000E+0
Loads	28	2319E+0	04 .4552E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	27	1638E+0	04 .5001E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Stress	MEM	3963E+0	03 .2062E+05	1664E+04	.2075E	+05	5 273E	+03	-85.5
			QUAD	FLATE NO. 5	54				
Loads	27	.3083E+0	044264E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	28	.2319E+0)44552E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	35	3003E+0	94 .4134E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	34	2399E+0	4 .4683E+04	.0000E+00	.0000E	+00	.0000E	-	.0000E+0
Stress	MEM	3966E+0		1664E+04	.2075E	+05	5275E	+03	-85.5
			DUAD	FLATE NO. 5	55				
Loads	34	.3712E+0	043729E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	35	.3003E+0	944134E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0
Loads	42	3613E+0)4 .3613E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+0

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Loads Stress Stress	Node Surf	Fx Sigma Shear X	X Z	Fy Sigma Y Shear YZ	Fz Tau XY	Mx Sigma	1	My Sigma	2	Mz Angle
Stress	MEM	3964E+	·03		1664E+04	-	 +05	5273E	 +03	-85.5
				DUAD F		56				·
Loads	41			3102E+04	.0000E+00	.0000E		.0000E		.0000E+00
Loads	42	.3613E+			.0000E+00	.0000E		.0000E		.0000E+00
Loads		4134E+	-	.3003E+04	.0000E+00	.0000E		.0000E		.0000E+00
Loads	48			.3712E+04	.0000E+00	.0000E	-	.0000E		.0000E+00
Stress	MEM	3963E+	.03		1665E+04	.2075E	+05	5273E	+03	-85.5
				@UAD F		57				
Loads	48	.4682E+			.0000E+00	.0000E		.0000E		.0000E+00
Loads	49			3003E+04	.0000E+00	.0000E		.0000E		.0000E+00
Loads		4553E+		.2320E+04	.0000E+00	.0000E		.0000E		.0000E+00
Loads		4263E+		.3083E+04	.0000E+00	.0000E		.0000E		.0000E+00
Stress	MEM	3963E+	03	.2062E+05		.2075E	+05	5273E	+03	-85.5
				DUAD F	LATE NO. 5	58				
Loads	55			1637E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	56	.4553E+	04	2320E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	63	4860E+	-04	.1579E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	62	4693E+	04	.2378E+04	.0000E+00	.0000E	+QQ	.0000E	+00	.0000E+00
Stress	MEM	3963E+	-03	.2062E+05	1664E+04	.2075E	+05	5272E	+03	-85.5
				QUAD F	LATE NO. 5	59				
Loads	62	.5194E+	04	8347E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	63	.4860E+	04	1579E+04	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	70	5047E+	04	.7993E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	69	5007E+	04	.1614E+04	.0000E+00	.0000E	400	.0000E	400	.0000E+00
Stress	MEM	3963E+	03	.2062E+05	1664E+04	.2075E	+05	5273E	+03	-85.5
				DUAD F	LATE NO. 6	O				
Loads	69	.5261E+	04	1187E+02	.0000E+00	.0000E	QQ+	.0000E	+00	.0000E+00
Loads	70	.5047E+	04	7993E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	77	5110E+	04	6903E-09	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Loads	76	5198E+	04	.8112E+03	.0000E+00	.0000E	+00	.0000E	+00	.0000E+00
Stress	MEM	3963E+	03	.2062E+05	1664E+04	.2075E	+05	5273E	+03	-85.5

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SOLVE PLATE LOADS/STRESSES Version 1.1 02/01/85

MAXIMUM STRESS SUMMARY FOR PLATES WITHIN SPECIFIED RANGE

Maximum (absolute) Stress = .2346E+05 at Plate 1

Plate Sigma X Sigma Y Tau XY

1 -.9660E+03 -.2346E+05 .1781E+04

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 Load Case 1:

REACTIONS

Node	Fx	Fy	Fz	М×	My	Mz
1	.0000E+00	.4770E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
2	.0000E+00	.8251E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
3	.0000E+00	.4672E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
4	.0000E+00	.5339E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00
5	.0000E+00	4269E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
6	.0000E+00	8367E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
7	.0000E+00	5110E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00
71	.4770E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
72	.8251E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
73	.4671E+04	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
74	.5309E+02	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00
75	1-					

PART NUMBER: 12585816, Outer Breech Band

DESCRIPTION: OUTER BREECH BAND

The breech band design consists of an inner breech band and an outer beech band. The two-piece design was developed to simplify disassembly of the tube and breech when the tube needs replacing after extended use or if other maintenance activities require disassembly.

STATUS:

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TO THE RESERVE THE PARTY OF THE

Dimensions for the outer breech band (TDF, Dwg. 12585816) except for porting were determined and are supported by analysis. Dimensional tolerances have yet to be determined. A 1/4 symmetric FEA model was used to evaluate stresses. Model results indicate a factor of safety for bending stress of 1.88 when 6061–162 Aluminum is used for the material. A summary of the stress analysis results and the supporting calculations are found on the following pages of this section.

AUTHORS: Joe Turek, Joe Fishbein

OUTER BREECH BAND

A FEM was used to evaluate stresses in the outer breech band. A 1/4 symmetric model was used. The 79,000 lb. recoil thrust is applied to the inner radius of the band, and is supported at the recoil cylinder attachment points.

Maximum stresses occur as a result of bending at the center of the band. The actual section at this point differs slightly from the model; however, because the system is statically determinate, the moment is accurate. Based on the actual section, bending stress is 18,629 PSI. For the 6061-T62 Aluminum specified (Yield stress = 35,000 PSI), the factor of safety is 1.88. Specifying a material with a greater yield will increase the safety factor.

The circular lip inside the recoil cylinder attachment hole was also examined. It was assumed that one cylinder had failed, and the remaining three cylinders shared the load equally. The lip was analyzed as an annular plate, loaded on the inside radius and with a fixed outer edge. Maximum bending stress is 9,972 PSI, for a FS of 3.51.

LOAD ALGNG
INNER DIAMETER

MAX. BENDING STRESS

CIRCULAR LIP

OUTER BAND

BREECH BANDS

8

23

(3) (3)

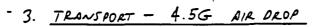
1

1. RECOIL THRUST -	- 79,00	O LB.
--------------------	---------	-------

_NOT6;	WHEN CHECKING STRESSES IN CYLINDER _SOCKET
.	OF OUTER BAND, IT WAS ASSUMED THAT ONE CYLINDER
• • • •	HAD FAILED, AND THRUST _ WAS CARRIED _ BY
	REMAINING THREE

2. TRANSPORT - BUMP + SKID

FORCE	NODE 1	NODE 2:
FX	-3 700 /b	-3500 16
FY	8600 B	-16400 16
FZ .	3100 B	-7600 16
MX	0	0 .
MY	-9200 m.16	-1400 12-16
MZ	4900 m.16	26,200 12-16



FORCE	NODE 1	NODE Z
F×	-600 LB.	600 LB.
FY	-9800 Us.	-7700 <i>U</i> 8.
FZ	/00 LB.	-100 LB.
MX	0	Ø
MY	-22820 In-LB.	20900 m.16
MZ	-27200 in.16.	23800 m.16

33

4 APPLIED MECHANICS

Analyst 9/17
Project Number

EC. No. Date
1-27.8

OUTER BREECH BAND

MRTIL: ALUMINUM 6061-T62 OR T651 PLATE

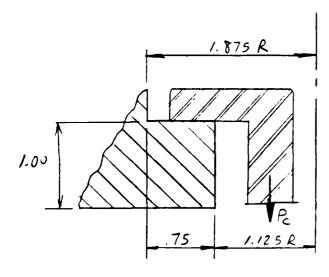
LOADED AT INNER RADIUS BY INNER BAD

RESISTED BY RECOIL CYLINDERS & CORNERS

LOAD PER CYLINDER (ASSUMING FAILURE OF ONE CYLINDER)

Pc = 7900 16 = 26,333 16

a) INNER LING OF CYLINDER ROD SOCKET



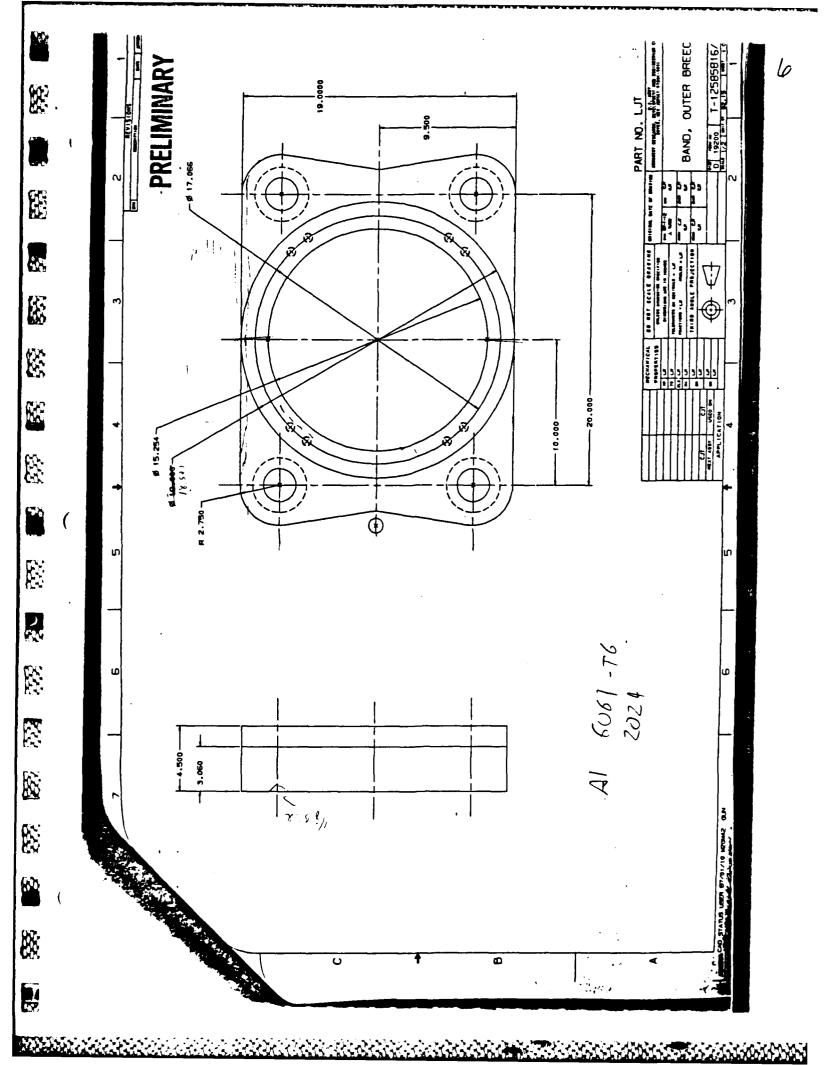
esessi i personal in concepta in lessessical in personal incorporati

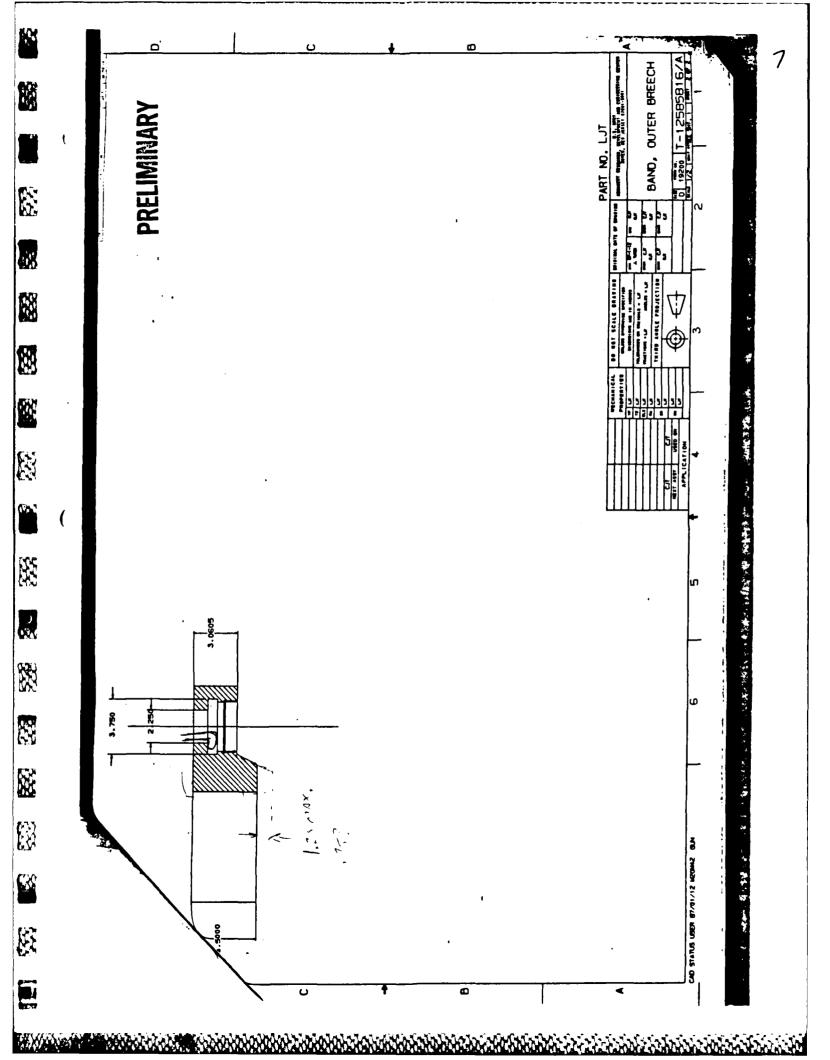
sheet and plate/mechanical properties

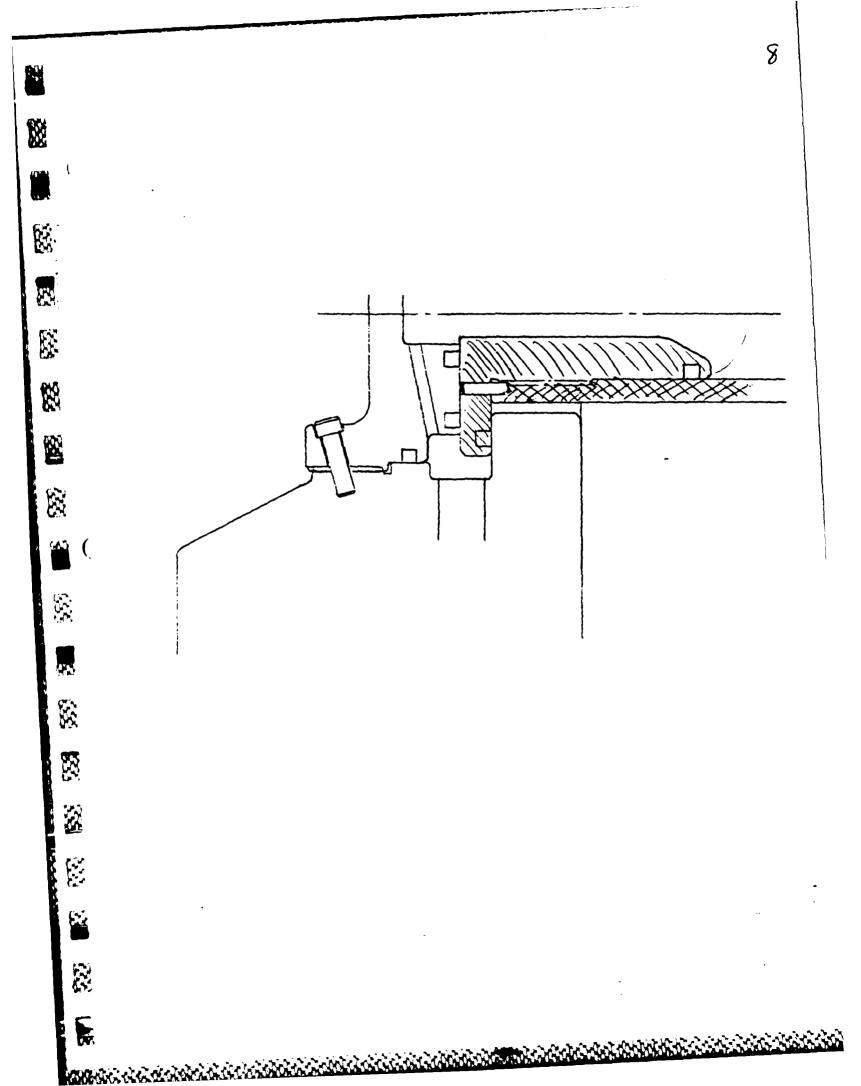
TABLE 7.2 Mechanical Property Limits—Heat-Treatable Alloys® (continued)

ALLOY	SPECIFIED		ELONGATION			
AND Temper	THICKNESS®	ULTIMATE		AUET	PERCENT MIN IN 2 IN.	
		min]	mex	min	mex	OR 4D®
		2219 (Cont	inued)			,
219-T87	0.020-0.039	64.0	• •	52.0	••	5
Ret sheet and plate	0.040-0.249	64.0	••	52.0	•• .	6
	0.250-1.000 1.001-2.000	64.0 64.0	• •	51.0 51.0	• •	7 6
	2.001-3.000	64.0	••	51.0 51.0	• •	6
	3.001-4.000	62.0	• •	50.0	• •	4
	4.001~5.000	61.0	• •	49.0	• •	3
		ALCLAD 2	219 ()	·		
icled 2219-0	0.020-0.499		32.0		16.0	12
Sheet and plate	0.500-2.000		32.00		16.03	
Voted 2219-T31®	0.040-0.099	42.0		25.0		10
Flat sheet	0.100-0.249	44.0	• •	26.0	••	10
Icled 2219-T351 OD Plate	0.250-0.499	44.0		26.0		10
icled 2219-TT37®	0.040-0.099	45.0		34.0		6
Flat sheet and plate	0.100-0.249	47.0		35.0	• •	6
	0.250-0.499	47.0		35.0	••	6
Uclad 2219-T62@@	0.020-0.039	44.0		29.0	• •	6
Sheet and plate	0.040-0.099	49.0	• •	32.0		7
	0.100-0.249	51.0	••	34.0	• •	7
	0.250-0.499	51.0	••	34.0	• •	8
	0.500-1.000	54.00	••	36.00		8
	1.001-2.000	54.00	••	36.00		7
Iclad 2219-T81	0.0200.039	49.0		37.0		6
Flat sheet	0.0400.099	55.0	• •	41.0	• •	7
	0.100-0.249	58.0		43.0		7
Iciad 2219-T851® Plate	0.250-0.499	58.0	<u></u>	42.0	• •	8
Vicled 2219-T87	0.0400.099	57.0		46.0		6
Flat sheet and plate	0.100-0.249	60.0		48.0		6
	0.250-0.499	60.0		48.0		7
		0061				
061-0	0.006-0.007		2 2.0		12.0	10
Sheet and plate	0.008-0.009	!	22 .0	1	12.0	12
•	0.010-0.020		2 2.0		12.0	14
	0.021-0.128		22 .0		12.0	16
	0.1290.499	•••	22 .0		12.0	18
	0.5001.000	!	22.0			18
	1.001-3.000		22.0			16
061-T4	0.006-0.007	30.0		16.0		10
Sheet	0.008-0.009	30.0	• •	16.0		12
	0.010-0.020	30.0	• •	16.0	• •	14
	0.021-0.249	30.0		16.0		16
061-T451 👁 Plate	0.250-1.000 1.001-3.000	30.0 30.0	••	16.0 16.0		18 16
	 			14.0		10
061-T42@®	0.006-0.007 0.008-0.009	30.0 30.0	• •	14.0	• •	12
Sheet and plate	0.008-0.009	30.0	• • •	14.0	• •	14
	0.010-0.020	30.0	• • •	14.0		16
	0.250-1.000	30.0		14.0	• •	18
	1.001-3.000	30.0	• • •	14.0	• • • • • • • • • • • • • • • • • • • •	16
061-T6 and T62@®	0.006-0.007	42.0		35.0		4
Sheet	0.0080.009	42.0		35.0	••	6
	0.010-0.020	42.0		35.0		8
	0.021-0.249	42.0	•••	35.0	••	10
061-T62®® and	0.250-0.499	42.0		35.0	• • • • • • • • • • • • • • • • • • • •	10
T651® Plate	0.500-1.000	42.0		35.0		9
	1.001-2.000	42.0		35.0	• •	8
	2.001-4.000	42.0		35.0	• •	6
	4.001-6.000®	40.0		35.0		6

For all numbered footnotes, see page 118









Analyst

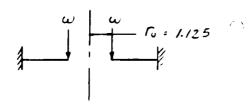
LTHD

EC. No.



RFF: ROARK, TBL. 24-/e

CONSGRUCTIVE + ASSUME POINT LOAD & GOCE OF LIP:



$$\omega = \frac{26.333 / s}{2\pi (r.)} = 3725.4 / b / m (2)$$

$$D = \frac{E t^3}{12(1-2r^2)} = 915751 \text{ in 16}$$
 (3)

$$C_1 = \frac{1+2r}{2} \frac{b}{a} / \frac{a}{b} + \frac{1-r}{4} \left(\frac{a}{b} - \frac{b}{a} \right) = .3859$$

$$C_4 = \frac{1}{2} \left[(1+v) \frac{b}{a} + (1-v) \frac{a}{b} \right] = .9733 (5)$$

$$C_7 = \frac{1}{2} (1 - v^2) \left(\frac{a}{b} - \frac{b}{a} \right) = .4853 (3)$$

$$L_3 = \frac{r_0}{4a} \left\{ \left[\left(\frac{r_0}{a} \right)^2 + 1 \right] \ell_n \frac{a}{r_0} + \left(\frac{r_0}{a} \right)^2 - 1 \right\} = .0082 \quad (7)$$

$$l_6 = \frac{r_0}{4a} \left[\left(\frac{r_0}{a} \right)^2 - 1 + 2 \ln \frac{a}{r_0} \right] = .0572 (3)$$

$$L_9 = \frac{r_c}{a} \left\{ \frac{1+v}{2} \ln \frac{a}{r_0} + \frac{1+v}{4} \left[1 - \left(\frac{r_c}{a} \right)^2 \right] \right\} = .2664 \quad (3)$$

图

APPLIED MECHANICS

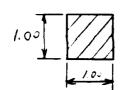
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LTHD	Project Number				
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$$\frac{\sqrt{L^{2} - w_{2}^{3}}}{D} \left(\frac{C_{1}L_{6}}{C_{4}} - L_{3} \right) = -.0004 \text{ in}$$

$$M_{r_{2}} = -w_{2} \left(L_{9} - \frac{C_{7}L_{6}}{C_{4}} \right) = \frac{1662 \text{ in} \cdot 16}{\text{in}}$$

$$Q_{2} = -\frac{\omega r_{3}}{a} = 2235 \frac{\frac{1}{2}}{\frac{1}{2}}$$

"SECTION" OUTR 1.00 in UF CIRCUMFERRICE



$$A = 1.00 \text{ m}^2$$
 $I = .0833 \text{ m}^2$
 $5 = .1667 \text{ m}^3$

$$\frac{76 = \frac{1662 \text{ in . /b}}{.1667 \text{ in }^3} = 9972 \text{ psi} \qquad FS = \frac{35000}{9972} = 3.51$$

$$7 = 2235 \text{ psi} \qquad FS \cdot \frac{(.58)(3500)}{2235} = 9.08$$

APPLIED MECHANICS

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Analyst

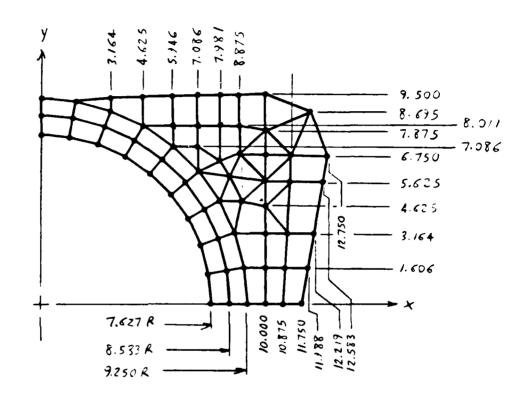
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11

BREECH BAND



APPLIED MECHANICS

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Project Number

EC. No. Date /-25.57

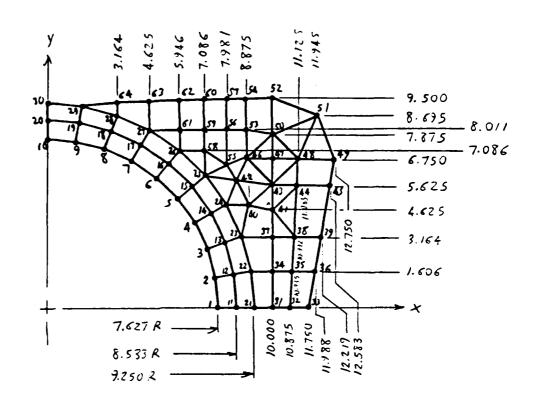


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NODAL POINTS



APPLIED MECHANICS

LTHD

Analyst

SMT

Project Number

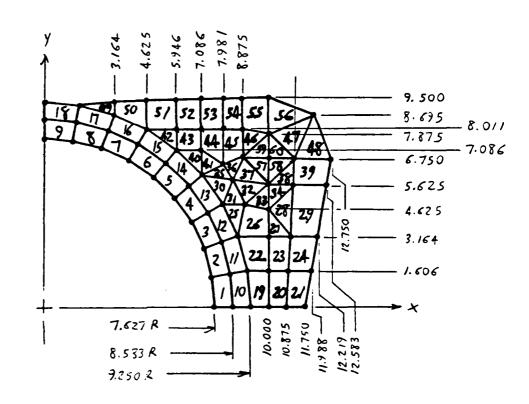
EC. No.

Date
/-25-87



BREECH BAND

ELEMENTS



4.500 THE MAT 1

3.780 THK MAT 1

3.061 THE MAT 1

3.061 THK MAT 2

MAT ID	E	P	d	ν	
	10.0×106	.098	-	. 3	(6061-T6 A1)
2	30 × 106	.001	-	. 3	(DUMMY MATIL)

B

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Subject

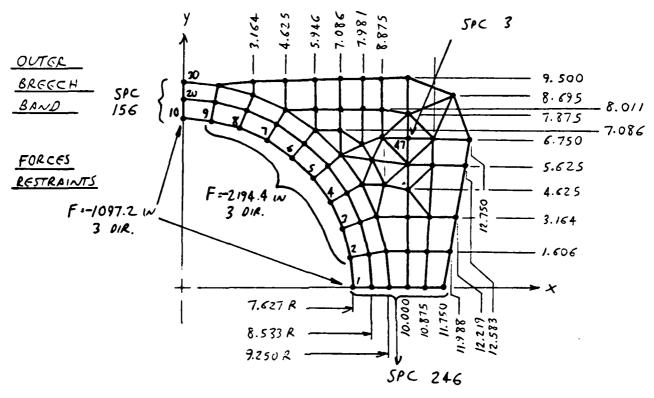
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Project Number

EC. No.

Date
1-25.57

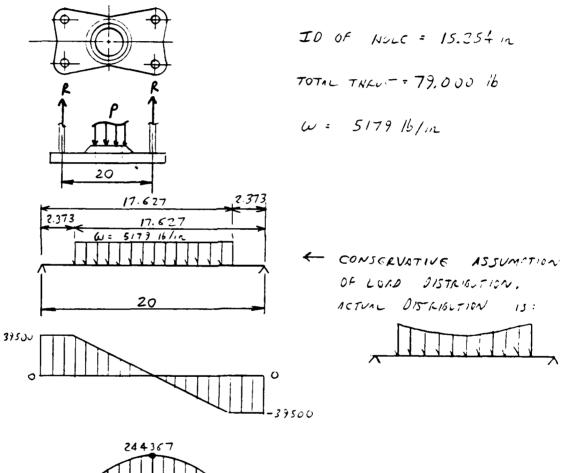




APPLIED MECHANICS

		, , ,
ubject	Analyst	9.75
LTHD	Project Number	
	EC. No.	Date 1.27.87

APPROXIMILTE BENDING STRESS



93734 M(in.16)

Max. DEFLECTION (FROM FEA) = -.0356 in

V (16)

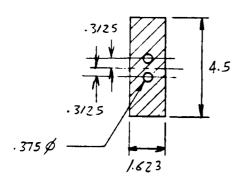
XX

APPLIED **MECHANICS**

Analyst 9117 LTHD



SECTION @ CENTER



$$A = (4.5)(1.623) - \frac{2\pi (.375)^2}{4} = 7.0826 m^2$$

$$I = \frac{(1.623)(4.5)^3/12 - 2\pi(.375)^4}{64} - \frac{(2\pi(.375)^2)}{4} (.3725)^2 = 12.301/12^4$$

$$5: \mathbb{Z}/2.25: 5.467 m^3$$
 (2)

$$\overline{J_b} : \frac{241367 \text{ m-1b}}{2(5.467 \text{ m}^3)} = 22349 \text{ ps}$$

$$FS = 1.57$$

BENSING MONER FROM FEA:

EMy & NOGS 10,20 + 30 = 10/850 m.16

13 13 13

17 **APPLIED MECHANICS**

		IVIE	CHA
ubject	Analyst	2117	Imp
LTHP	Project Number	Ü	<u></u>
L/177	EC. No.	Date 1-29 87	
			

BEARING STRESS FROM INNER RING

CONTRCT AREA =
$$Tr[(16)^2 - (15.504)^2]$$
 = 12.273/n²

$$V_{br}$$
, = $\frac{79000 \text{ lb}}{12.273 \text{ ln}^2}$ = 6437 ps; F5 = 5.44

•	S SSSSSS	C	מסססס	11	331	3333	ć	566666	5555	555555	Ō	φφορί	90	•
ļ	5555555	C	00000	11	33	3333	ć	566666	5555	555555	Q	<u>Ο</u> ΦΦΟ)O	ŧ
!	88	00	מס	1111	33	33	66		55		OO		QΦ	•
1	SS	00	00	1111	33	33	66		55		00		\mathbf{O}	ţ
•	55	00	00	1 1		33	66		5555	55	00	Ç	QQQC	4
!	55	00	0 0	11		33	66		5 5555	55	QQ.	Ç	QQQC	ļ
4	555555	00	0 0	1 1		33	666	666666		55	\overline{OO}	OO	QQ.	!
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!	S S	00	00	11	33	33	66	66	5 5	55	00		QQ.	ţ
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, i														

FMC CORPORATION S/N:800484

. Job	Information
! ! Project	: LTHD
Client	:
. Job Name	: Outer Breech Band
: ! Remarks !	: 1/4 symmetric model under recoil load
! ! Engineer !	J. Fishbein
: ! Chk'd by !	:/
! ! Appr'd by !	:/
! Comments	:
! !	
!	

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Interactive Microcomputer Analysis & Graphics of Engineering Systems

IMAGES-3D Version 1.3 03/01/86

RUN ID=S013650

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Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

MATERIAL PROPERTIES

Material	Modulus of	Weight	Coeff of Thermal Exp.	Poisson's	Shear Web
No	Elasticity	Density		Ratio	Modulus
1 2	1.00000E+07 3.00000E+07	9.80000E-02 1.00000E-03	0.00000E+00	3.00E-01 3.00E-01	0.00000E+00

NODE COORDINATES

Node	X-Coord.	Y-Coord.	Z-Coord.
1	7.62700E+00	0.00000E+00	0.00000E+00
2	7.51113E+00	1.32441E+00	0.00000E+00
3	7.16704E+00	2.60859E+00	0.00000E+00
4	6.60518E+00	3.81350E+00	0.00000E+00
5	5.84262E+00	4.90254E+00	0.00000E+00
5	4.90254E+00	5.84262E+00	0.00000E+00
7	3.81350E>00		
-		6.60518E+00	0.00000E+00
8	2.60859E+00	7.16704E+00	0.00000E+00
9	1.32441E+00	7.51113E+00	0.00000E+00
10	0.00000E+00	7.62700E+00	0.00000E+00
11	8.53300E+00	0.00000E+00	0.00000E+00
12	8.40337E+00	1.48174E+00	0.00000E+00
13	8.01840E+00	2.91846E+00	0.00000E+00
14	7.38980E+00	4.26650E+00	0.00000E+00
15	6.5 3666E+00	5.48491E+00	0.00000E+00
16	5.48491E+00	6.53666E+00	0.00000E+00
17	4.26650E+00	7.38980E+00	0.00000E+00
18	2.91846E+00	B.01840E+00	0.00000E+00
19	1.4B174E+00	8.40337E+00	0.00000E+00
20	0.00000E+00	B.53300E+00	0.00000E+00
21	9.25000E+00	0.00000E+00	0.00000E+00
22	9.10947E+00	1.60625E+00	0.00000E+00
23	B.69216E+00	3.16369E+00	0.00000E+00
24	B.01073E+00	4.62500E+00	0.00000E+00
25	7.08591E+00	5.94579E+00	0.00000E+00
26	5.94579E+00	7.08591E+00	0.00000E+00
27	4.62500E+00	8.01074E+00	0.00000E+00
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CHECK GEOMETRY

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LTHD Outer Breech Band -- Recoil Load

Node	X-Coord.	Y-Coord.	Z-Coord.
28	3.16369E+00	B.69216E+00	0.00000E+00
29	1.60625E+00	9.10947E+00	0.00000E+00
30	0.00000E+00	9.25000E+00	0.00000E+00
31	1.00000E+01	0.00000E+00	0.00000E+00
32	1.08750E+01	0.00000E+00	0.00000E+00
33	1.17500E+01	0.00000E+00	0.00000E+00
34	1.00000E+01	1.60600E+00	0.00000E+00
35	1.09350E+01	1.60600E+00	0.00000E+00
36	1.198B0E+01	1.60600E+00	0.00000E+00
37	1.00000E+01	3.16400E+00	0.00000E+00
38	1.09920E+01	3.16400E+00	0.00000E+00
39	1.22190E+01	3.16400E+00	0.00000E+00
40	8.87500E+00	4.62500E+00	0.00000E+00
41	1.00000E+01	4.62500E+00	0.00000E+00
42	8.42800E+00	5.62500E+00	0.00000E+00
43	1.00000E+01	5.62500E+00	0.00000E+00
44	1.10830E+01	5.62500E+00	0.00000E+00
45	1.25830E+01	5.62500E+00	0.00000E+00
46	8.87500E+00	6.75000E+00	0.00000E+00
47	1.00000E+01	6.75000E+00	0.00000E+00
48	1.11250E+01	6.75000E+00	0.00000E+00
49	1.27500E+01	6.75000E+00	0.00000E+00
50	1.00000E+01	7.87500E+00	0.00000E+00
51	1.19450E+01	8.69500E+00	0.00000E+00
52	1.00000E+01	9.50000E+00	0.00000E+00
53	8.87500E+00	8.01100E+00	0.00000E+00
54	8.87500E+00	9.50000E+00	0.00000E+00
55	7.98100E+00	6.75000E+00	0.00000E+00
56	7.98100E+00	B.01100E+00	0.00000E+00
57	7.98100E+00	9.50000E+00	0.00000E+00
58	7.08600E+00	7.08600E+00	0.00000E+00
59	7.08600E+00	B.01100E+00	0.00000E+00
60	7.08600E+00	9.50000E+00	0.00000E+00
61	5.94600E+00	8.01100E+00	0.00000E+00
62	5.94600E+00	9.50000E+00	0.00000E+00
63	4.62500E+00	9.50000E+00	0.00000E+00
64	3.16400E+00	9.50000E+00	0.00000E+00

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LTHD Outer Breech Band -- Recoil Load

FLATE ELEMENT CONNECTIVITY

L-5 •							1 27		COMMECTIV.	k 1 1		
	!	Plate No.	N I	o d	e s .	L	Mat No.	Thickness	Area	Shear Web Thickness	Aspect Ratio	Flate Type
	DUAD	1	1	1 1	12	2	1	4.500E+00	1.271E+00		6.408E-01	Mem+Bend
	QUAD	2	2	12	13	3	1	4.500E+00	1.271E+00		6.408E-01	Mem+Bend
33	DUAD	3	3	13	14	4	1	4.500E+00	1.271E+00		6.408E-01	Mem+Bend
	QUAD	4	4	14	15	5	1	4.500E+00	1.271E+00		6.40BE-01	Mem+Bend
1147	DUAD	5	5	15	16	6	1	4.500E+00	1.271E+00		6.408E-01	Mem+Rend
	DUAD	6	6	16	17	7	1	4.500E+00	1.271E+00		6.408E-01	Mem+Bend
6.54	QUAD	フ	7	17	18	8	1	4.500E+00	1.271E+00		6.408E-01	Mem+Eend
	DUAD	8	8	18	19	9	1	4.500E+00	1.271E+00		6.408E-01	Mem+Bend
$\mathcal{O}_{\mathcal{A}}$	DUAD	5	9	19	20	10	1	4.500E+00	1.271E+00		6.408E-01	Men+Bend
	QUAD	10	11	21	22	12	1	3.780E+00	1.107E+00		4.609E-01	Mem+Bend
_	QUAD	11	12	22	23	13	1	3.780E+00	1.107E+00		4.609E-01	Mem+Bend
· . ·	DUAD	12	13	23	24	14	1	3.780E+00	1.107E+00		4.609E-01	Mem+Bendi
	DUAD	13	14	24	25	15	1	3.780E+00	1.107E+00		4.609E-01	Mem+Bend
	QUAD	14	15	25	26	16	1	3.780E+00	1.107E+00		4.609E-01	Mem+Bend
	/ IAD	15	16	26	27	17	1	3.780E+00	1.107E+00		4.609E-01	Mem+Bend
متحط	J.JAD	16	17	27	28	18	1	3.780E+00	1.107E+00		4.609E-01	Mem+Bend
D	DUAD	17	18	28	29	19	1	3.7B0E+00	1.107E+00		4.609E-01	Mem+Bend
## T	QUAD	18	19	29	30	20	1	3.780E+00	1.107E+00		4.609E-01	Mem+Bend
	DUAD	19	21	31	34	22	1	3.061E+00	1.317E+00		5.102E-01	Mem+Bend
	QUAD	20	31	32	35	- 4	1	3.061E+00	1.453E+00		5.634E-01	Mem+Bend
	QUAD	21	32	33	36	35	1	3.061E+00	1.548E+00		5.977E-01	Mem+Bend
	DUAD	22	22	34	37	23	1	3.061E+00	1.712E+00		6.994E-01	Mem+Bend
	DUAD	23	34	35	38	37	1	3.061E+00	1.501E+00		6.183E-01	Mem+Bend
	DUAD	24	35	36	39	38	1	3.061E+00	1.776E+00		7.286E-01	Mem+Bend
#CN	TRI	25	24	23	40		1	3.061E+00	6.315E-01		1.794E+00	Mem+Bend
	QUAD	26	23	37	41	40	1	3.061E+00	1.777E+00		8.309E-01	Mem+Bend
333	TRI	27	37	38	41		1	3.061E+00	7.247E-01		6.429E-01	Mem+Bend
0.0	TRI	28	41	38	44		1	3.061E+00	1.287E+00		9.664E-01	Mem+Bend
	DUAD	29	38	39	45	44	1	3.061E+00	3.356E+00		5.517E-01	Mem+Bend
,	TRI	30	25	24	42		1	3.061E+00	7.380E-01		1.710E+00	Mem+Bend
	TF:I	31	24	40	42		1	3.061E+00	4.321E-01		8.6420-01	Mem+Bend
ж".	TRI	32	42	40	4 🖰		1	3.061E+00	7.860E-01		7.616E-01	Mem+Bend
	TRI	33	40	41	43		1	3.061E+00	5.625E-01		9.805E-01	Mem+Bend
	TRI	34	41	44	43		1	3.061E+00	5.415E-01		2.000E+00	Mem+Bend
Ω.	TEI	35	25	42	55		1	3.061E+00	6.832E-01		1.393E+00	
	TRI	36	55	42	46		1	3.061E+00	5.029E-01		1.383E+00	Mem+Bend
y.,.	TRI	37	42	43	46		1	3.061E+00	8.842E-01		1.338E+00	
	TRI	38	43	44	48		1	3.061E+00	6.092E-01		B.546E-01	
Y 14.	DUAD	39	44	45	49	48		3.061E+00			1.383E+00	Mem+Bend
	$\pm e/I$	4 0	26	25	58		1	3.061E+00	6.500E-01		2.000E+00	Mem+Bend
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CHECK GEOMETRY

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LTHD Outer Breech Band -- Recoil Load

	Flate		0 0	e 5		Mat			Shear Web	Aspect	Flate
	No.	I	J 		L 	No.	Thickness	Area	Thickness	Ratio	Type
TRI	41	25	55	58		1	3.061E+00	5.103E-01		1.394E+00	Mem+Bend
TEI	42	27	26	61		1	3.061E+00	6.110E-01		1.999E+00	Mem+Rend
DUAI	45	26	58	59	61	1	3.061E+00	1.055E+00		1.232E+00	Mem+Bend
PLIAI	44	58	55	56	59	1	J.061E+00	5.782E-01		8.331E-01	Mem+Bend
OUAI	45	55	46	53	56	1	3.061E+00	1.127E+00		7.090E-01	Mem+Bend
TRI	46	46	50	53		1	3.061E+00	7.093E-01		1.774E+00	Mem+Fend
TF:I	47	50	48	51		1	J.061E+00	1.555E+00		8.137E-01	Mem+Bend
TEI	48	48	45	51		1	3.061E+00	1.580E+00		B.355E-01	Mem+Rend
TRI	49	29	28	64		1	3.061E+00	6.291E-01		1.641E+00	Mem+Bend
DUAI	50	28	27	63	64	1	3.061E+00	1.678E+00		1.306E+00	Men+Bend
DUAI	51	27	61	62	63	1	3.061E+00	1.967E+00		8.871E-01	Mem+Bend
DUAL	52	61	59	60	62	1	3.061E+00	1.697E+00		7.656E-01	Mem+Fend
QUAI	53	59	56	57	60	1	3.061E+00	1.333E+00		6.011E-01	Mem+Bend
CLIAI	54	56	53	54	57	1	3.061E+00	1.331E+00		6.004E-01	Mem+Beind
DUAI	55	53	50	52	54	1	3.061E+00	1.752E+00		7.239E+01	Mem+Bend
TRI	56	50	51	52		1	3.061E+00	1.580E+00		1.356E+00	Mem+Bend
TRI	57	45	43	47		2	3.061E+00	6.328E-01		2.000E+00	Mem+Bend
TRI	58	43	48	47		2	3.061E+00	6.328E-01		2.000E+00	Mem+Bend
("I	59	46	47	50		2	3.061E+00	6.328E-01		8.944E-01	Mem+Bend
Ind	60	47	48	50		2	3.061E+00	6.328E-01		B.944E-01	Mem+Bend

RESTRAINTS

Node No				tra: ect:	int ion:	5
1	_	Υ	_	FιX	-	FίΖ
10	X	_	_		ŔΥ	F:Z
11	-	Υ	~	RΧ	-	F.Z
20	X	-	_		FΥ	FΖ
21	-	Υ	_	FΧ	-	RΖ
5 0	X	_		_	RY	RZ
31	-	Υ	-	F(X	-	RΖ
32	_	Y	-	FίΧ	-	FίΖ
33	_	Υ	_	F:X	_	F:Z
47	_	-	Z	_	_	_

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RENUMBER NODES

Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

Node Renumbering Cross Reference List

Was	Is	Was	Is	Was	Is
1	22	2	23	3	24
4	25	5	25	6	4 1
フ	50	8	58	9	61
10	64	11	13	12	14
1.3	15	14	21	15	Ծ1
16	39	17	46	16	55
19	60	20	63	21	7
20	6	23	12	24	20
25	30	26	38	27	47
28	54	29	59	30	62
31	2	32	1	33	5
34	4	35	3	36	6
37	10	38	9	39	11
40	19	41	16	42	29
43	26	44	17	45	18
46	33	47	7.4	48	27
49	28	50	35	51	36
52	44	53	42	54	45
55	37	55	43	57	51
58	40	59	46	60	52
61	49	62	53	63	56
64	57			-	20

Original Nodal Band 38 Final Nodal band 12

								~ <i>_</i>
18 1		51	52	53	54	55	56	\rightarrow
L_3 \ 8	7 16	15	43	44	45	46 59	4 68	48
		6 5	14	35	V	37 57	58 38	39
			4	13 30	31\25	32 33	34 28	29
			Y	3 1	2 /2/	26	27	}
			·	2	11	22	23	24
				1	1	19	20	21
				L				

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ASSEMBLE STIFFNESS MATRIX Version 1.3 03/01/86

LTHD Duter Breech Band -- Recoil Load

STIFFNESS ASSEMBLY SUMMARY

Number	of	Node Foints	64
Number	₽f	Truss and Beam Elements	Ó
Number	o f	Flate Elements	60
Number	of	Spring Elements	Ó
Number	Ωf	Nodes with Restraints	10
Number	of.	Blocks in the Matrix	2

BLOCK NUMBER 1

FORM Matrix FACE Matrix Size = 112504 Bytes TRIANGULARIZE Matrix

BLDCH NUMBER 2

FORM Matrix PACE Matrix Size = 20504 Bytes TRIANGULARIZE Matrix

Number of terms in the matrix. 17001 Largest column..... 69 Minimum Diagonal Stiffness = .8153958D+03 Mailmum Diagonal Stiffness = .7044191D+10

CONTRACT SECURITY INCOMES SECURITY IN THE PROPERTY OF THE PROP

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ASSEMBLE STIFFNESS MATRIX Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

DRDSS REFERENCE LIST

Is Node Verus Internal Equation Number

Is	TRANSLATION /			ROTATION		
Node	Eqn.	Eqn.	Eqn. /	/ Eqn.	Eqn.	Eqn.
				/		
1	1		2		3	
2	4		5		6	
3	7	8	9	10	11	12
4	13	14	15	16	17	18
5	19		20		21	
6	22	23	24	25	26	27
7	28		29		30	
8	31	32	33	34	35	36
9	37	38	39	40	41	42
10	43	44	45	4 6	47	48
11	49	50	51	52	5 3	54
12	55	56	57	58	59	60
13	61		62		63	
14	64	65	6 6	67	68	69
15	70	71	72	73	74	75
16	76	77	78	79	80	81
17	82	83	84	85	86	87
18	8 8	89	90	91	92	93
19	94	95	96	9 7	98	99
20	100	101	102	103	104	105
21	106	107	108	109	110	111
22	112		113		114	
23	115	116	117	118	119	120
24	121	122	123	124	125	126
25	127	128	129	130	131	132
26	133	134	135	136	137	138
27	139	140	141	142	143	144
28	145	146	147	148	149	150
29	151	152	153	154	155	156
30	157	158	159	160	161	162
31	163	164	165	166	167	168
32	169	170	171	172	173	174
33	175	176	177	178	179	180
34	181	182		185	184	185
35	186	187	188	189	190	191
36	192	193	194	195	196	197
37 30	198	199	200	201	202	203
38 38	204	205	206	207	208	209
39	210	211	212	213	214	215

ASSEMBLE STIFFNESS MATRIX Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

I⊊		ANSLAT		/			
Node	Eqn.	Eqn.	Eqn.	/	Eqn.	Egn.	Eqn.
				/			
4 O	216	217	218		219	220	221
41	222	223	224		225	226	227
42	228	229	230		231	232	233
43	234	235	236		237	238	239
44	240	241	242		243	244	245
45	246	247	248		249	250	251
46	252	253	254		255	256	257
47	258	259	260		261	262	263
48	264	265	266		267	268	269
49	270	271	272		273	274	275
50	276	277	278		279	280	281
51	282	283	284		285	286	287
52	288	289	290		291	292	293
53	294	295	296		297	298	299
54	200	301	302		303	304	305
55	306	307	308		309	310	311
56	312	313	314		315	316	317
57	318	319	320		321	322	323
58	324	325	326		327	328	329
59	330	331	332		333	334	335
60	336	337	33		339	340	341
61	342	343	344		345	346	347
62		348	349		350		
63		351	352		353		
64		354	355		356		

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SOLVE DISPLACEMENTS

Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

LOAD CASE 1

CONCENTRATED LOADS

Node	Fx	Fy	Fz	Mix	My	Mz
1	.0000E+00	.0000E+00	1097E+04	.0000E+00	.0000E+00	.0000E+00
2	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
3	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
4	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
5	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
6	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
7	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
8	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
9	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
10	.0000E+00	.0000E+00	1097E+04	.0000E+00	.0000E+00	.0000E+00

FMC CORPORATION S/N:800484

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SOLVE DISPLACEMENTS

Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

LOAD CASE 1

APPLIED LOAD VECTOR

Node	Fx	Fy	F≢	М×	My	Mz
1	.0000E+00	.0000E+00	1097E+04	.0000E+00	.0000E+00	.0000E+00
2	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
3	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
4	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
5	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
6	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
7	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
8	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
9	.0000E+00	.0000E+00	2194E+04	.0000E+00	.0000E+00	.0000E+00
10	.0000E+00	.0000E+00	1097E+04	.0000E+00	.0000E+00	.0000E+00

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SOLVE DISPLACEMENTS

Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

LOAD CASE 1

DISPLACEMENTS

		nslatio	n s /	R' ⊂	tatio	n s
Node	X	Υ	Z /	X	Υ	7
1	.0000E+00	.0000E+001	.635E-01 /	.0000E+00	5449E-02	.0000E+00
2	.0000E+00	.0000E+001			5418E-02	.0000E+00
3	.0000E+00	.0000E+001	801E-01 /	.6119E-03	5320E-02	.0000E+00
4	.0000E+00	.0000E+002		.8252E-03	5135E-02	.0000E+00
5	.0000E+00	.0000E+002	290E-01 /		4822E-02	.0000E+00
6	.0000E+00	.0000E+002			4323E-02	.0000E+00
7	.0000E+00	.0000E+002	965E-01 /	.1231E-02	3595E-02	.0000E+00
8	.0000E+00	.0000E+003	26BE-01 /	.1335E-02	2618E-02	.0000E+00
9	.0000E+00	.0000E+003	479E-01 /	.1409E-02	1390E-02	.0000E+00
10	.0000E+00	.0000E+003	555E-01 /	.1443E-02	.0000E+00	.0000E+00
11	.0000E+00	.0000E+001	145E-01 /	.0000E+00	5393E-02	.0000E+00
12	.0000E+00	.0000E+001	191E-01 /	.3186E-03	5371E-02	.0000E+00
13	.0000E+00	.0000E+001	331E-01 /	.5790E-03	5300E-02	.0000E+00
14	.0000E+00	.0000E+001	570E-01 /	.7525E-03	5157E-02	.0000E+00
15	.0000E+00	.0000E+001	901E-01 /	.8532E-03	4889E-02	.0000E+00
16	.0000E+00	.0000E+002	298E-01 /	.9325E-03	4428E-02	.0000E+00
17	.0000E+00	.0000E+002	712E-01 /	.1012E-02	3720E-02	.0000E+00
18	.0000E+00	.0000E+003	084E-01 /	.1086E-02	2737E-02	.0000E+00
19	.0000E+00	.0000E+003		.1129E-02	1462E-02	.0000E+00
20	.0000E+00	.0000E+003	438E-01 /		.0000E+00	.0000E+00
21	.0000E+00	.0000E+007			5361E-02	.0000E+00
22	.0000E+00	.0000E+00E	8085E-02 /	.3221E-03	5351E-02	.0000E+00
23	.0000E+00	.0000E+009	598E-02 /	.5790E-03	5313E-02	.0000E+00
24	.0000E+00	.0000E+001		.7364E-03	5216E-02	.0000E+00
25	.0000E+00	.0000E+001			4988E-02	.0000E+00
26	.0000E+00	.0000E+002			4547E-02	.0000E+00
27	.0000E+00	.0000E+002			3841E-02	.0000E+00
28	.0000E+00	.0000E+002			2848E-02	.0000E+00
29	.0000E+00	.0000E+003			1528E-02	.0000E+00
30	.0000E+00	.0000E+003			.0000E+00	.0000E+00
31	.0000E+00	.0000E+003			5336E-02	.0000E+00
32	.0000E+00		071E-02 /		5298E-02	.0000E+00
37	.0000E+00		687E-02 /		5246E-02	.0000E+00
34	.0000E+00	.0000E+003	-		5340E-02	.0000E+00
35	.0000E+00		658E-02 /		5313E-02	.0000E+00
36	.0000E+00		230E-02 /		5264E-02	,0000E+00
37 	.0000E+00	.0000E+002			5349E-02	.0000E+00
38	.0000E+00		682E-02 /		5340E-02	.0000E+00
39	.0000E+00		210E-02 /		5301E-02	00000E+00
40	.0000E+00	.0000E+007	609F-07 /	.7360E-03	5316E-02	. 0 000E+00

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FMC CORPORATION S/N:800484
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SOLVE DISFLACEMENTS

Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

LOAD CASE 1

	Tra	nslat:	ions	1	R o	tatio	n s
Node	X	Y	Z	/	X	Υ	7
41	.0000E+00	.0000E+00	1647E-02	/	.7395E-03	5362E-02	.0000E+00
42	.0000E+00	.0000E+00	9266E-02	1	.7815E-03	5286E-02	.0000E+00
4종	.0000E+00	.0000E+00	8761E-03	/	.7958E-03	5359E-02	.0000E+00
44	.0000E+00	.0000E+00	.4920E-02	1	.7915E-03	5342E-02	.0000E+00
45	.0000E+00	.0000E+00	.1292E-01	1	.7954E-03	5329E-02	.0000E+00
46	.0000E+00	.0000E+00	6021E-02	1	.7635E-03	5338E-02	.0000E+00
47	.0000E+00	.0000E+00	.0000E+00	/	.7601E-03	5359E-02	.0000E+00
48	.0000E+00	.0000E+00	.6021E-02	/	.7627E-03	5347E-02	.0000E+00
49	.0000E+00	.0000E+00	.1471E-01	/	.7840E-03	5343E-02	.0000E+00
50	.0000E+00	.0000E+00	.8248E-03	1	.7055E-03	5362E-02	.0000E+00
51	.0000E+00	.0000E+00	.1184E-01	1	.7111E-03	5375E-02	.0000E+00
52	.0000E+00	.0000E+00	.1931E-02	1	.6604E-03	5383E-02	.0000E+00
53	.0000E+00	.0000E+00	5092E-02	1	.7047E-03	5308E-02	.0000E+00
54	.0000E+00	.0000E+00	4090E-02	1	.6418E-03	5301E-02	.0000E+00
55	.0000E+00	.00000E+00	1073E-01	/	.7766E-03	5189E-02	.0000E+00
56	.0000E+00	.0000E+00	9779E-02	1	.7249E-03	5160E-02	.0000E+00
57	.0000E+00	.0000E+00	8768E-02	1	.6313E-03	5146E-02	.0000E+00
58	.0000E+00	.0000E+00	1501E-01	1	.7910E-03	4952E-02	.0000E+00
59	.0000E+00	.0000E+00	1430E-01	/	.7453E-03	4918E-02	.0000E+00
60	.0000E+00	.0000E+00	1327E-01	/	.6233E-03	4895E-02	.0000E+00
61	.0000E+ 0 0	.0000E+00	1967E-01	/	.7887E-03	4495E-02	.0000E+00
62	.0000E+00	.0000E+00	1861E-01	/	.6275E-03	4438E-02	.0000E+00
63	.0000E+00	.0000E+00	2403E-01	/	.6728E-03	3742E-02	.0000E+00
64	.0000E+00	.0000E+00	2882E-01	/	.7310E-03	2802E-02	.0000E+00

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SOLVE FLATE LOADS/STRESSES Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

Load Case 1:

ACCOUNT WAYNER BESTELL BOOMSON E

PLATE LOADS AND/OR STRESSES

Stress Stress	Surf	Sigma Shear		Sigma Shear		Tau	XY	Sigma	1	Sigma	2	Angle
				****	JAD F	FLATE N	10.	1***				
Stress	TOF	32620	E+05	52418	E+04	.4296	E+03	2889E	+03	52788	E+04	5.0
Stress	MID	.00000	E+00	. 00000	E+00	.0000	E+00	.0000E	+00	. 00008	E+00	.0
Stress	BOT	.32626	E+03	.5241	E+04	4296	E+03	.5278E	+04	.28898	E+03	-85.0
				01	JAD F	PLATE N	10.	2				
Stress	TOP	51826	E+03	46116	E+04	.5523	E+03	4450E	+03	4685E	E+04	7.6
Stress	MID	. 00000	E+00	. 00001	E+00	.0000	E+00	.0000E	+00	. 0000E	E+00	• 0
Stress	BOT	.51820	E+03	.4611	E+04	5523	E+03	.4685E	+04	.4450E	E03	-82.4
				0(JAD I	FLATE N	iO.	3				
Stress	TOF			3940	E+04	.1157	E+04	4910E	+03	432BB	E+04	18.5
Stress	MID	. 00000	E + 00	. 00001	E+00	.0000	E+00	.0000E	+ QO	. 0000E	E + 00	.0
Stress	BOT	.8790	E+03	.3940	E+04	1157	E+04	.4328E	+04	.4910E	E+03	-71.5
				****	JAD F	FLATE N	10.	4***				
Stress	TOF	12516	E+04	420BE	E+04	.2333	E+04			5492E		28.8
Stress	MID	. 0000E	E+00	. 00001	E+00	.0000	E+00	.0000E	+00	. 0000E	E+00	.0
Stress	BOT	.1251	E+04	.4208	E+04	2333	E+04	.5492E	+04	3273E	E+02	-61.2
						FLATE N	-	5***				
Stress	TOF			62718						B305E		28.7
Stress	MID	. 0000				.0000				.0000E		.0
Stress	BOT	.1506	E+04			~.3719			+04	5279E	E+03	-61.3
						PLATE N		6***				
Stress				57628						1197E		24.7
Stress	MID	.00001								.00008		. 0
Stress	BOT	. 1513	E+04			~.4810			+05	69868	E+03	-65.3
						FLATE N		7 ***				
Stress				14118						1599E		19.7
Stress	MID									.0000E		.0
Stress	BOT	.1283	-+04			5255			+05	5945	E+03	- 70. 3
				****	A CAL	PLATE N	u.	B+**				

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Version 1.3 03/01/86

		Outer B	Breed	ch Band	1	Recoil (Load			M	ax. 5	TRESS
Load Ca	ISP :	1:								1/	VM	ODEL
Stress Stress	Surf	Sigma Shear		Sigma Shear		Tau)	XY	Sigma	i 	Sigma	2	Angle
Stress	TOF	8238E	 E+03	18898	E+05	.4831	E+04	.3872E	+03	2010E	+94	14.1
Stress	MID	.0000E	+00	. 0000E	00+3	.0000	E+00	.0000E	+00	.0000€	+00 /	.0
Stress	BOT	.8238E	EQ+3	.18896	E+05	4831	E+04	.2010E	+05	7872E	(+03 📗	-75.9
				D!	JAD I	FLATE NO	J.	9		/	_ ^	
Stress	TOF'	3332E	EO+	2236E	E+05	.3089	E+04		+024	/- (2278E	:+05)	7.8
Stress	MID	.0000E	00+3	.0000E	200 +3	. 0000	E+00	بيانين شاند	4	. OOGOE	+00	.0
Stress	BOT	.3332E	E0#3	.22366	E+05	30898	E+04	₹227BE		<i>.</i> 9190E	+02	-82.2
_				` ***⊡(JAD H	FLATE NO	J. 1	(F > F				
Stress	TOF	5471E	E0 +3	40608	E+04	.2117	E+03	5344E	+03	4073E	+04	3.4
Stress	MID	.0000E	00+	.0000E	00+3	. 00000	E+00	.0000E	+00	.0000E	+00	.0
Stress	BOT	.5471E	E0+3	. 4060E	E+04	2117	E+03	.4073E	+04	.5344E	+03	-86.6
				×××⊕l	JAD F	PLATE NO	J. 1	1***				
Stress	TOP	9810E	E0+3	3509E	E+04	.1270	E+03	9747E	+03	3515E	+04	2.9
Stress	MID	.0000E	00+3	. 0000E	E+00	.0000	E+00	.0000E	+QQ	.0000E	+00	.0
Stress	BOT	.9810E	£0#3	.35098	E+04	1270	E+03	.3515E	+04	.9747E	+03	-87.1
				Di	JAD I	FLATE NO	J. 1	2				
Stress	TOF'	1745E	+04	28658	E+04	.5176	E+03	1542E	+ ⊕4	3067E	+04	21.4
Stress	MID	.0000E	400	.0000E	00+3	. 00000	E+00	.0000E	+00	.0000E	+00	• 0
Stress	BOT	.1745E	+04	.28658	E+04	5176	E+03	.3067E	+04	.1542E	+04	-68.6
				÷∗∗⊕L	JAD F	PLATE NO	J. 1	3***				
Stress	TOF	2429E	+04	2953E	E+04	.15356	E+04	1134E	+04	4248E	+04	40.2
Stress	MID	.0000E	+00	.0000E	00+3	. 0000E	E+ 00	.0000E	+00	.0000E	+00	• O
Stress	BOT	.2429E	+04	. 29538	E+04	~.15358	E+04	.4248E	+04	.1134E	+04	~49.8
				OL	JAD F	PLATE NO). i	4				
Stress	TOF	2717E	+04	4606E	E+04	. 27978	E+04	7089E	+03	6613E	+04	35.7
Stress	MID	.0000E	+00	.00008	+ 00	. 00006	E+00	.0000E	+00	.0000E	+ 00	.0
Stress	BOT	: .2717E	+04	. 4606E	E+04	2797	E+04	.6613E	+04	.7089E	+03	-54.3
				DU	JAD F	PLATE NO). 1	5				
Stress	TOP	2464E	+04	7404E	E+04	.3814	E+04	3903E	+03	9478E	+04	28.5
Stress	MID	.0000E	+00	. 0000E	00+3	. 0000E	E+00	.0000E	+00	.0000E	+00	• 0
Stress	BOT	.2464E	+04			38140		.9478E	+04	.3903E	£0+)	~61.5
				01	JAD F	PLATE NO) . 1	6				
Stress	TOF	1876E	+04	10898	E+05	↓4281 €	E+04	1669E	+03	1260E	+05	21.8
Stress	MID	.0000E	+00	. 0000E	00+3	, 0000E	00+3	. 0000E	+ 00	.0000E	+ 00	• Q
Stress	BOT	.1876E	+04	.10898	+05	←. 42818	E+04	.1260E	+05	.1669E	+03	-68.2
				DL	JAD F	PLATE NO	3. 1	7				

Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

Load Case 1:

Stress Stress	Surf		Sigma Y Shear YZ	Tau XY	Sigma 1	Sigma 2	Angle
Stress	TOP	9420E+03	1482E+05	.4137E+04	.1973E+03	1596E+05	15.4
Stress	MID	.0000E+00	.0000E+00	.0000E+00	,0000E+00	.0000E+00	.0
Stress	BOT	.9420E+03	.1482E+05	4137E+04	.1596E+05	1973E+03	-74.6
			DUAD F	LATE NO. 1	B		
Stress	TOP	2109E+03	7.1787E+05	.2520E+04	.1415E+03,	1823E+05	8.0
Stress	MID	•	.0000E+00	.0000E+00	.0000E+00	.0000E+00	. 0
Stress	BOT	.2109E+03	→ .1787E+05	2520E+04	+1823E+05	1415E+03	-82.0
			DUAD F		9		
Stress	TOF	6491E+03	3254E+04	.2416E+02	6489E+03	3255E+04	.5
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00		.0
Stress	BOT	.6491E+03		2416E+02	.3255E+04	.6489E+03	-89.5
			DUAD F	LATE NO. 2	O		
Stress	TOF	4165E+03	3220E+04	6876E+02	4148E+03	3222E+04	-1.4
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00		.0
Stress	BOT	.4165E+03	.3220E+04	.6876E+02	.3222E+04	.4148E+03	88.6
			DUAD F	LATE NO. 2	1		
Stress	TOF		3277E+04	1511E+03	1716E+03	3284E+04	-2.B
Stress	MID	.0000E+00	.0000E+00		•	.0000E+00	.0
Stress	BOT	.1789E+03	.3277E+04	.1511E+03	.3284E+04	.1716E+03	87.2
			QUAD F	LATE NO. 2	2		
Stress	TOF	1031E+04	2846E+04	.4795E+02	1029E+04	2847E+04	1.5
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0
Stress	FOT	.1031E+04		4795E+02	.2847E+04	.1029E+04	-88.5
			QUAD F	LATE NO. 2	3		
Stress	TOF		2699E+04				-3.2
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	• 0
Stress	BOT	. 5 230E+03	.2699E+04	.1235E+03	.2706E+04	.5160E+03	86.8
			QUAD F		4		
Stress	TOF	1832E+03	2576E+04		1573E+03	2602E+04	-5.9
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0
Stress	BOT	.1832E+03	.2576E+04	.2503E+03	.2602E+04	.1573E+03	84.1
			TRIANGULA		25		
Stress			2421E+04			2537E+04	-52.7
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0
Stress	BOT	.2470E+04	.2421E+04	.8787E+02	.2537E+04	.2354E+04	37.3
			DUAD F	LATE NO. 2	6		

Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

Load Case 1:

Stress Stress	Surf	Sigma X Shear XZ	Sigma Y Shear YZ	Tau XY	Sigma 1	Sigma 2	Angle
Stress	TOF	1112E+04	1990E+04	3177E+02	1111E+04	1991E+04	-2.1
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	• 0
Stress	POT	.1112E+04	.1990E+04	.3177E+02	.1991E+04	.1111E+04	87.9
		4	***TRIANGULAR	R PLATE NO.	27***		
Stress	TOF	394BE+03	1791E+04 -	1020E+03	3874E+03	5179BE+04	-4.2
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0
Stress	FOT	.3948E+03	.1791E+04	.1020E+03	.179BE+04	.3874E+03	85.8
		4	***TRIANGULAR	R PLATE NO.	28***		
Stress	TOF	1072E+04	3176E+03	.5086E+03	6150E+02	1328E+04	63.3
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0
Stress	BOT	.1072E+04	.3176E+03 -	5086E+03	.1328E+04	.6150E+02	-26.7
			DUAD FI	LATE NO. 2	29		
Stress	TOF	7437E+02	1218E+04 ·	1025E+03	6525E+02	21227E+04	-5.1
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00		.0
Stress	BOT	.7437E+02	.1218E+04	.1025E+03	.1227E+04	.6525E+02	84.9
			***TRIANGULA				
Stress	TÜ₽	2685E+04	3099E+04 -	9932E+03	1878E+04	3907E+04	-39.1
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00		.0
Stress	BOT	.2685E+04		.9932E+03	.3907E+04	.1878E+04	50.9
			***TRIANGULAR				
Stress	TOF'	2184E+04	1349E+04 -				-81.5
Stress	MID	.0000E+00		.0000E+00	.0000E+00		.0
Stress	BOT	.2184E+04		.1268E+03	.2203E+04	.1331E+04	8.5
		•	***TRIANGULA	R FLATE NO.			
Stress	TOP		1035E+04	.1434E+02			67.1
Stress	MID	.0000E+00		.0000E+00	.0000E+00		• 0
Stress	BOT	.1062E+04	.1035E+04 ·		.1069E+04	.1029E+04	-22.9
			***TRIANGULAF				
Stress	TOP			5460E+00			2
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00		.0
Stress	BOT	.9700E+03	.1153E+04	.5460E+00	.1153E+04	.9700E+03	89.6
			***TRIANGULAR				
Stress	TOF'		5182E+03 -				-39.9
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00		.0
Stress	BOT	.3674E+03	.5182E+03	.4201E+03	.8696E+03	.1595E+02	50.1
		4	***TRIANGULAF	R FLATE NO.	35***		

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Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

Load Case 1:

Stress Stress	Surf	Sigma X Shear XZ	Sigma Y Shear YZ	Tau XY	Sigma 1	Sigma 2	Angle
Stress	TOP	3584E+04	1031E+04	5350E+03	9239E+03	3691E+04	-78.6
Stress	MID	.0000E+00		.0000E+00	.0000E+00	.0000E+00	.0
Stress	BOT	.3584E+04	.1051E+04	.5350E+03	.3691E+04	.9239E+03	11.4
			TRIANGULA	R PLATE NO.	36		
Stress	TOF	1102E+04	2340E+04	8687E+03	6539E+03	2788E+04	-27.3
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0
Stress	BOT	.1102E+04	.2340E+04	.8687E+03	.2788E+04	.6539E+03	62.7
			TRIANGULA	R PLATE NO.	. Z7		
Stress	TOF	6789E+03	.9696E+02	2170E+03	.1535E+03	7355E+03	-75.4
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0
Stress	BOT	.6789E+03	9696E+02	.2170E+03	.7355E+03	1535E+03	14.6
		•	***TRIANGULA	R FLATE NO.	38***		
Stress	TOF	.3945E+03		7366E+01	.5079E+03	.3940E+03	-86.3
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0
Stress	BOT	3945E+03	5075E+03	.7366E+01	3940E+03	5079E+03	3.7
			DUAD F	LATE NO. 3	59		
Stress	TOP	.1865E+03	.3407E+03	1015E+03	.3910E+03	.1362E+03	-63.6
Stress	MID	.0000E+00		.0000E+00	.0000E+00	.0000E+00	. 0
Stress	BOT	1865E+03				3910E+03	26 .4
			***TRIANGULA				
Stress	TOP	4220E+04	3321E+04	2150E+04	1574E+04	5967E+04	-50.9
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0
Stress	BOT	.4220E+04		.2150E+04	.5967E+04	.1574E+04	39.1
			***TRIANGULA				
Stress	TOP	2512E+04	2783E+04	.1568E+04	1074E+04	4222E+04	42.5
Stress	MID	.0000E+00		.0000E+00	.0000E+00	.0000E+00	• O
Stress	BOT	.2512E+04		1568E+04	.4222E+04	.1074E+04	-47.5
			***TRIANGULA				
Stress	TOF		2962E+04			8112E+04	-61.5
Stress	MID	.0000E+00		.0000E+00	.0000E+00	.0000E+00	• 0
Stress	BOT	.6589E+04	.2962E+04	.2801E+04	.8112E+04	.1439E+04	28.5
			DUAD F		\$3		
Stress	TOF	5837E+04		.5218E+03		5891E+04	84.0
Stress	MID	.0000E+00		.0000E+00	.0000E+00	.0000E+00	• 0
Stress	BOT	.5837E+04		5218E+03	.5891E+04	.8758E+03	-6.0
			DUAD F	'LATE NO. 4	14		

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LTHD Outer Breech Band -- Recoil Load

Load Case 1:

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Stress Stress	Surf	Sigma X Shear XZ	Sigma Y Shear YZ	Tau XY	Sigma 1	Sigma 2	Angle
Stress	TOF	3955E+04	8001E+03	9377E+03	5424E+03	4213E+04	-74.6
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	. 0
Stress	BOT	.3955E+04	.8001E+03	.9377E+03	.4213E+04	.5424E+03	15.4
			DUAD PI	LATE NO. 4	45		
Stress	TOF	2575E+04	1016E+03	.2477E+03	7704E+02	2600E+04	84.3
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0
Stress	FOT	.2575E+04	.1016E+03 ·	2477E+03	.2600E+04	.7704E+02	-5.7
			TRIANGULA	R FLATE NO.	46		
Stress	TOF	.1895E+03	1551E+03	.5399E+03	.5840E+03	5495E+03	36.2
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	• O
Stress	BOT	1895E+03	.1551E+03 ·	5399E+03	.5495E+03	5840E+03	-53.8
			TRIANGULA	R FLATE NO.	47		
Stress	TOP	.5388E+03	.1740E+03 ·	2053E+03	.6310E+03	.8174E+02	-24.2
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	. 0
Stress	BOT	5388E+03	1740E+03	.2053E+03	8174E+02	6310E+03	65.8
_			***TRIANGULA	R PLATE NO.	. 48* **		
Stress	TOP	.2047E+03	.5520E+03 ·	1681E+03	.6201E+03	.1366E+03	-68.0
Stress	MID	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.0000E+00	• O
Stress	ECIT	2047E+03	5520E+03	.1681E+03	1366E+03	6201E+03	22.0
			***TRIANGULA				
Stress	TOF	1232E+05	7887E+03 -	2554E+04	2484E+03		-78.1
Stress	MID	.0000E+00		.0000E+00	.0000E+00	.0000E+00	.0
Stress	BOT	.1232E+05		.2554E+04	.1286E+05	.2484E+03	11.9
			QUAD FL		50		
Stress			1469E+04 -				-69.7
Stress	MID	.0000E+00		.0000E+00	.0000E+00	.0000E+00	• O
Stress	BOT	.8897E+04		.3177E+04	.1007E+05	.2956E+03	20.3
			QUAD PL		51		
Stress		7965E+04			4417E+03		85. 3
Stress	MID	.0000E+00		.0000E+00	.0000E+00		.0
Stress	BOT	.7965E+04			.8016E+04	.4417E+03	-4.7
			QUAD PL		52		
Stress		6015E+04				6029E+04	B7.2
Stress	MID	.0000E+00		.0000E+00	.0000E+00		.0
Stress	BOT	.6015E+04			.6029E+04	.3353E+03	-2.8
			DUAD Fil	ATE NO. 5	53		

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LTHD Outer Breech Band -- Recoil Load

Load Case 1:

Stress TOP4267E+041724E+03 .1144E+031692E+034271E+04 Stress MID .0000E+00 .0000E+00 .0000E+00 .0000E+00 Stress BOT .4267E+04 .1724E+031144E+03 .4271E+04 .1692E+03	Angle								
Stress BOT .4267E+04 .1724E+031144E+03 .4271E+04 .1692E+03	88.4								
DUAD FLATE NO. 54 Stress TOP2586E+04 .2821E+02 .7266E+02 .3023E+022588E+04 Stress MID .0000E+00 .0000E+00 .0000E+00 .0000E+00 Stress BOT .2586E+042821E+027266E+02 .2588E+043023E+02 ***DUAD FLATE NO. 55*** Stress TOP8128E+03 .2452E+031989E+03 .2814E+038489E+03	• 0								
DUAD FLATE NO. 54 Stress TOP2586E+04 .2821E+02 .7266E+02 .3023E+022588E+04 Stress MID .0000E+00 .0000E+00 .0000E+00 .0000E+00 Stress BOT .2586E+042821E+027266E+02 .2588E+043023E+02 ***DUAD FLATE NO. 55*** Stress TOP8128E+03 .2452E+031989E+03 .2814E+038489E+03	-1.6								
Stress MID .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .5tress BOT .2586E+042821E+027266E+02 .2588E+043023E+02 ***OUAD FLATE NO. 55*** Stress TOP8128E+03 .2452E+031989E+03 .2814E+038489E+03									
Stress BOT .2586E+042821E+027266E+02 .2588E+043023E+02 ***OUAD FLATE NO. 55*** Stress TOP8128E+03 .2452E+031989E+03 .2814E+038489E+03	88.4								
OUAD FLATE NO. 55 Stress TOP8128E+03 .2452E+031989E+03 .2814E+038489E+03	• 0								
Stress TOP8128E+03 .2452E+031989E+03 .2814E+038489E+03	-1.6								
	DUAD FLATE NO. 55								
AL LINE COLUMN C	-79.7								
Stress MID .0000E+00 .0000E+00 .0000E+00 .0000E+00	• O								
Stress BOT .8128E+032452E+03 .1989E+03 .8489E+032814E+03	10.3								
TRIANGULAR FLATE NO. 56									
Stress TOP .5106E+02 .5257E+03 .8835E+01 .5258E+03 .5089E+02	88.9								
Stress MID .0000E+00 .0000E+00 .0000E+00 .0000E+00	.0								
Stress BOT5106E+025257E+038835E+015089E+025258E+03	-1.1								
TRIANGULAR FLATE NO. 57									
Stress TOP .3817E+03 .4883E+038872E+03 .1324E+044538E+03	-46.7								
Stress MID .0000E+00 .0000E+00 .0000E+00 .0000E+00	.0								
Stress BOT3817E+034883E+03 .8872E+03 .4538E+031324E+04	43.3								
TRIANGULAR PLATE NO. 58									
Stress TOP .1347E+04 .1428E+04 .3744E+03 .1764E+04 .1011E+04	48.1								
Stress MID .0000E+00 .0000E+00 .0000E+00 .0000E+00	• O								
. Stress BOT1347E+041428E+043744E+031011E+041764E+04	-41.9								
TRIANGULAR PLATE ND. 59									
Stress TOP1983E+03 .2169E+04 .1423E+02 .2169E+041984E+03	89.7								
Stress MID .0000E+00 .0000E+00 .0000E+00 .0000E+00	• <u>o</u>								
Stress BOT .1983E+032169E+041423E+02 .1984E+032169E+04	3								
TRIANGULAR FLATE NO. 60									
Stress TOP .1267E+04 .2608E+047965E+02 .2613E+04 .1262E+04	-86.6								
Stress MID .0000E+00 .0000E+00 .0000E+00 .0000E+00	. 0								
Stress BOT1267E+042608E+04 .7965E+021262E+042613E+04	□.4								

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SOLVE PLATE LOADS/STRESSES Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

Load Dase 1:

MAXIMUM STRESS SUMMARY FOR PLATES WITHIN SPECIFIED RANGE 1- 60

Marimum (absolute) Stress = .2236E+05 at Plate 9

FMC CORPORATION S/N:800464

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SOLVE REACTIONS

Version 1.3 03/01/86

LTHD Outer Breech Band -- Recoil Load

Load Case 1:

REACTIONS

Node	F×	Fy	Fz	Mic	My	Mz
1	.0000E+00	.0000E+00	.00000E+00	1040E+05	.0000E+00	.0000E+00
10	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.4008E+05	.0000E+00
11	.0000E+00	.0000E+00	.0000E+00	1105E+05	.0000E+00	.0000E+00
20	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.4926E+05	.0000E+00
21	.0000E+00	.0000E+00	.0000E+00	4687E+04	.0000E+00	.0000E+00
30	.0000E+00	.0000E+00	.0000E+00	.0000E+00	.1251E+05	.0000E+00
31	.0000E+00	.0000E+00	.0000E+00	4040E+04	.0000E+00	.0000E+00
32	.0000E+00	.0000E+00	.0000E+00	4553E+04	.0000E+00	.0000E+00
33	.0000E+00	.0000E+00	.0000E+00	2921E+04	.0000E+00	.0000E+00
47	.0000E+00	.0000E+00	.1975E+05	.0000E+00	.0000E+00	.0000E+00

2/11/87 TO WALL THK OUTER BAND P: PRESS. di= INSIDEDIA T = Pd1 USE MATE TEN STENGTE LYL PRESS $= \frac{3000.502}{2.375} = 2000$ 4.4 701 7. 375 = 15,000 USING 6061 MATRIX 15 = 58000 YIELD GENOW TEN TT = POLI = LONGITHDINAL STRESS 451NG 6061-76 = T651 4 40,000 T 45,000 PLATE 3 70 1

3-20-87 SLOTT RAGMOND

8

BAND (OUTER BAND) MATE FOR LONG LTRANLERCE SHOW TRANU 55 56 7075 T6 55 5 70 6"THK 6% 3% 2% 56 55 54 7075 - 7652 16% 1% 3% YELD ÉLANG. 15

L. MME

15 CHECKING OUT MATC'

BAND OUTER

45

ALCOM

LACK FIELD

893-3800

7075 TG51 PLATE

M,N

MIN

フ

THK 5" 44 KS1

61Ks1

570

EL

" 6" 40

X

(K)

X

59

5

FLATNESS ±,125 LOG. & TRANSU IN 6'

WILL SCND LETTER

12 WK L. TIME

STD MILL V

FOR A S.F. OF Z-1 45 KS, REQUIRED.

8.4375 1.875 X 4.25 = 1 1.825 X 4.50 = 1 1.875 x 4.50 = A BAND, OUTER 1/2/26 PLATE 9>

25,50 TRACK & PLATE BETWEEN CLEARANCE

1,875 = .50

0 1 20

70P & BORBUM

5,0

THE OF OUTER BAND PLATE
BETWEEN CYL. 47

W

1

7.7

48K \$ 70,000 - ran w 46,667 - ran WL - 48,000+20 - 55,384- $2 = \frac{6d^2}{6} = \frac{1.625 \times 16}{6} = 4.337$ $2 = \frac{1.625 \times 45}{6} = 43,760$ 7.5125